BEHAVIORAL AND BRAIN SCIENCES (2018), Page 1 of 63
doi:10.1017/S0140525X17000012, e1

Why do we remember? The communicative function of episodic memory

Johannes B. Mahr
Department of Cognitive Science, Cognitive Development Center, Central European University, 1051 Budapest, Hungary
mahr_johannes@phd.ceu.edu
https://cognitivescience.ceu.edu/people/johannes-mahr

Gergely Csibra
Department of Cognitive Science, Cognitive Development Center, Central European University, 1051 Budapest, Hungary
csibrag@ceu.edu
https://cognitivescience.ceu.edu/people/gergely-csibra

Abstract: Episodic memory has been analyzed in a number of different ways in both philosophy and psychology, and most controversy has centered on its self-referential, *autonoetic* character. Here, we offer a comprehensive characterization of episodic memory in representational terms and propose a novel functional account on this basis. We argue that episodic memory should be understood as a distinctive epistemic attitude taken toward an event simulation. In this view, episodic memory has a metarepresentational format and should not be equated with beliefs about the past. Instead, empirical findings suggest that the contents of human episodic memory are often constructed in the service of the explicit justification of such beliefs. Existing accounts of episodic memory function that have focused on explaining its constructive character through its role in future-oriented mental time travel do justice neither to its capacity to ground veridical beliefs about the past nor to its representational format. We provide an account of the metarepresentational structure of episodic memory in terms of its role in communicative interaction. The generative nature of recollection allows us to represent and communicate the reasons why we hold certain beliefs about the past. In this process, autonoesis corresponds to the capacity to determine when and how to assert epistemic authority in making claims about the past. A domain where such claims are indispensable are human social engagements. Such engagements commonly require the justification of entitlements and obligations, which is often possible only by explicit reference to specific past events.

Keywords: autonoesis; discursive commitment; episodic memory; epistemic authority; epistemic vigilance; event memory; mental time travel; metarepresentation

Humans are obsessed with their own past. A large part of our conscious mental lives is spent reminiscing about past experiences and sharing those experiences with others (Dessalles 2007b; Rimé et al. 1991). Psychologists have identified the basis of this obsession as originating in episodic memory. Since Endel Tulving (1972) introduced the concept, the idea that human long-term declarative memory can be partitioned into two separate systems – one semantic and one episodic – has become widely accepted across the field. This agreement, however, has done little to clarify more basic questions about the function of the episodic memory system. Traditionally, most memory research has been preoccupied with studying the capabilities of human memory rather than aiming to illuminate its function. Given the centrality and ubiquity of episodic memory in our lives, it is surprising that the question of the "proper function" (Millikan 1984) of episodic memory has received attention only in recent years (Boyer 2008; 2009; Conway 2005; Cosmides & Tooby 2000; Klein et al. 2002a; Michaelian 2016b; Schacter et al. 2011; Suddendorf & Corballis 1997; 2007).

In the present article, we argue that common accounts of episodic memory function have serious shortcomings, and

JOHANNES B. MAHR is a Ph.D. candidate in the Department of Cognitive Science at Central European University in Budapest. He studied philosophy and psychology in Munich and Edinburgh. His research focuses on the conceptual and empirical investigation of episodic memory in communicative contexts.

GERGELY CSIBRA is a Professor at the Department of Cognitive Science at Central European University, Budapest, and at the Department of Psychological Sciences, Birkbeck, University of London. He is currently conducting research on the cognitive development of human infants.

© Cambridge University Press 2018 0140-525X/18

https://doi.org/10.1017/S0140525X17000012 Published online by Cambridge University Press

we propose an alternative functional analysis. To do this, we will first have to explain what constitutes our object of investigation. Despite the central role it plays in the study of human memory, the concept of episodic memory is surprisingly hard to pin down. Thus, in section 1, we give and defend a precise characterization of episodic memory. In section 2, we scrutinize the most popular account of episodic memory function: the idea that our capacity to remember the past functions in the service of our capacity to imagine the future. Finally, in section 3, we propose an alternative account that views episodic memory as a mechanism supporting human communication specifically tailored to certain forms of cooperative social interactions.

In our view, episodic memory turns out to be crucial to the human capacity to communicate about past events. Although it is commonly acknowledged that episodic memory is both ontogenetically (Nelson 1993; Nelson & Fivush 2004) and phylogenetically (Suddendorf et al. 2009; Dessalles 2007a) connected to our capacity to communicate about the past, the exact nature of this connection is usually left underspecified. We propose that episodic memory is essential to managing our discursive commitments by demarcating the range of beliefs about which we can claim epistemic authority. The capacity to manage such commitments in turn contributes to the stabilization of human communication: By taking responsibility for the truth of an assertion (which comes at potential costs), speakers can provide reasons for listeners to believe them. Most importantly, this account can make sense of why episodic memory should be self-referential – a question that has been left unresolved in the literature so far. Moreover, this account can make sense of a range of empirical phenomena that are not obviously reconcilable with competing explanations.

Overall, our strategy is to reason from form to function: From the design features of the episodic memory system identified at the outset, we infer the cognitive tasks this system has likely been selected to solve. Nonetheless, our account does not make any claims as to the actual evolutionary history of episodic memory, and it addresses only the mature system as it operates in human adults. Although our account carries implications for what one should expect the development of episodic memory to look like and how far it should be shared between humans and other animals, these questions are not our focus here.

1. What is episodic memory?

The term *episodic memory* entered the repertoire of cognitive psychology some time ago, and is often presented as roughly corresponding in function to the use of the word "remembering" (Tulving 1985; Gardiner 2001). The fact that we seem to have no trouble identifying instances of remembering in everyday life, however, obscures many cognitive and conceptual subtleties in relation to episodic memory. The term is often used in slightly different ways by authors with differing theoretical inclinations.[1]

Human memory is typically partitioned into separate systems along two axes (Squire 1992): declarative/procedural and long-term/short-term. Within this taxonomy, there are two separate declarative, long-term memory systems: semantic memory and episodic memory. Therefore, the effort to understand episodic memory has traditionally focused on identifying those of its features that distinguish it from semantic memory.

Tulving (1972) originally defined episodic memory as memory for personally experienced past events. Episodic memory, in this conception, was thought to uniquely include information about what happened, when, and where (so-called WWW information). However, this kind of information can be represented in semantic memory as well (Klein 2013b): One can, for example, recall the storming of the Bastille in terms of WWW information purely by invoking semantic memory. Tulving (1983a; 1985; 2002a) thus subsequently amended his definition by adding that episodic memory is distinguishable from semantic memory because of its unique phenomenology. Whereas information in semantic memory is thought to be simply *known*, episodic memory comes with "mental time travel"; that is, when we remember an event, we re-experience the event as it occurred. Tulving labeled the different phenomenological states of semantic versus episodic memory as "noetic" and "autonoetic" consciousness, respectively.

Partly due to the phenomenological nature of this distinction, much discussion has focused on what autonoesis should be taken to be.[2] From this debate, two main lines of thinking have emerged. On the one hand, authors such as Russell and colleagues (Clayton & Russell 2009; Russell 2014; Russell & Hanna 2012; for a similar view, see Hills & Butterfill 2015) have proposed a minimal characterization of episodic memory. In this view, episodic memories are re-experienced and thus distinguished from semantic memory by the fact that their contents are WWW elements bound together into a holistic representation. That is, because such memories have spatiotemporal structure (such that predicates like "next to," "before," or "after" can be applied to their elements), and include perspectivity as well modality-specific sensory information, they carry all of the features of ongoing experience. Further, because such episodic memories would represent completed events, they could be identified as "past" in a minimal, non-conceptual sense (Russell & Hanna 2012). Autonoesis might then simply be a by-product of the quasi-experiential character of such recalled events.

On the other hand, many have argued that episodic memory includes more than just event information (Dokic 2001; Klein 2013b; 2014; 2015b; Klein & Nichols 2012; Perner 2001; Perner et al. 2007; Perner & Ruffman 1995). In this view, when we remember an episode, we represent more than just the event itself; we further represent that we had personal experience of the event in question. Specifically, Dokic (2001) has argued that we should understand the difference between episodic memory and other types of memory as evidenced by the fact that "genuine episodic memory gives the subject … a reason to believe that the information carried by it does not essentially derive from testimony or inference but comes directly from the subject's own past life" (p. 4). Klein and Nichols (2012) supported a similar view in their report of the case of patient RB, who seemed to have lost the capacity to autonoetically remember the past. This patient reported having lost the capacity to non-reflectively tell "from the first person, 'I had these experiences'" (p. 690). Autonoesis thus seems to carry propositional content to the effect that the information in question was acquired firsthand. To account for this circumstance, self-reflexive views of autonoesis

https://doi.org/10.1017/S0140525X17000012 Published online by Cambridge University Press

usually take episodic memory to be metarepresentational. After all, to represent that one's memory is the outcome of a past experience, one has to represent the representational character of the memory itself (Perner 1991).[3]

1.1. The structure of episodic memory

We now propose a characterization of episodic memory trying to reconcile the two views described above. Thereby, we distinguish between the contents of episodic memory, on the one hand, and its representational format, on the other.

1.1.1. The contents of episodic memory. Episodic memory shares many features with other capacities, such as imagination, dreaming, navigation, counterfactual thinking, and future planning (Addis et al. 2009; Buckner & Carroll 2006; De Brigard 2014a; Hassabis et al. 2007a; 2007b; Schacter et al. 2007; Spreng et al. 2009). The common denominator of all of these different capacities seems to be that they are subserved by a system that flexibly constructs richly contextualized scenarios on the basis of stored content (Hassabis & Maguire 2007; 2009). The neural substrate of this "scenario construction system" is localized in the medial temporal lobes, specifically in the hippocampus (Cheng et al. 2016; Maguire & Mullally 2013; Maguire et al. 2015). Constructed scenarios are thought to consist of simulations of events extended over time and space (Moser et al. 2008), and construction of a given scenario has been shown to activate the sensory cortex in a manner similar to the perception of that scenario (Wheeler et al. 2000).

Crucially, however, scenario construction has to be distinguished from stored information (i.e., the memory trace), on the one hand, and episodic memory on the other. Although debate exists about what, exactly, memory traces should be taken to be (De Brigard 2014b; Robins 2016b), there is little disagreement that they are not identical to the outputs of the scenario construction system (Cheng et al. 2016).[4] Instead, scenario construction enriches and recombines trace information depending on the function its output serves. Scenario construction subserves a range of different capacities, not just episodic memory: Imagination, dreaming, navigation, and planning make use of memory traces, too. All of these capacities are supported by our ability to store and retrieve information learned in specific situations in the past.

One way to understand the construction process in episodic memory retrieval is as a Bayesian inference with the aim to accurately reconstruct a past event on the basis of available evidence (De Brigard 2012; 2014a; Hemmer & Steyvers 2009). This evidence comes from the memory trace, on the one hand, and relevant semantic information on the other (Cheng et al. 2016). Depending on the functional role a given construction will play, the construction process will then rely more or less heavily on the memory trace or semantic information. For example, the construction of a counterfactual or future-oriented scenario should rely less heavily on trace as compared to semantic information. Indeed, patients with semantic dementia have been found to be impaired in constructing event simulations about the future (Irish et al. 2012a).

Some authors have proposed a radical constructivist view of episodic remembering, positing that memory traces essentially play no privileged role in the construction of the contents of episodic memory (e.g., Michaelian 2016a). Instead, these authors argued that there is no difference between inferences involved in the construction of factual and counterfactual scenarios (De Brigard 2014a). However, as Robins (2016a) has argued, based on an analysis of common memory errors (such as the famous Deese-Roediger-McDermott [DRM] effect; Roediger & McDermott 1995), episodic memory construction cannot be entirely independent of memory traces. Robins argues that such memory errors can occur only because some information has been retained. Thus, although it seems likely that the construction process does not have to rely on trace information, it will commonly take trace information into account. In particular, there must be differences in the way construction processes make use of stored information depending on whether the function of the construction is to represent an actual or possible occurrence. That is, in constructing a scenario representing an actual past event, the construction process should assign a privileged role to the memory trace in assigning probabilities to different priors.

The contents of episodic memory are, then, the outputs of a scenario construction mechanism. Such constructions would qualify as "minimal" episodic memory: They are quasi-experiential in the sense of including spatiotemporal context, perspectivity, and modality-specific sensory information. Scenario construction could then be taken to be sufficient for the representation of specific past events.

1.1.2. The format of episodic memory. Scenario construction alone is, however, not sufficient for episodic memory to occur: Hippocampus-based constructions become episodic memories only when they are conceptualized in a certain way, namely, as the outcome of past first-person experience. The event construction itself does not seem to differentiate between imagined and remembered scenarios. For this reason, some authors have proposed that autonoesis serves as a "memory index": a representational tag differentiating episodic memories from imaginations (Klein 2014; Michaelian 2016a). In this view, the difference between imagined and remembered scenarios equates to the difference between factual and counterfactual event representations. Autonoesis would then allow us to differentiate between factual and counterfactual representations. However, if the content of autonoesis is indeed a proposition to the effect of "I had these experiences," it alone cannot differentiate counterfactual from factual event representations. Instead, autonoesis marks those events of which one had firsthand experience as opposed to some other source.

To see this, note that both remembering and imagining a particular past event are compatible with the belief that the event indeed occurred. One can (even accurately) imagine a past event that one believes to have occurred. This is, in fact, common when we represent events of which we have only secondhand information (see also Pillemer et al. 2015). Thus, although autonoesis does indeed serve as a memory index, it does so by effectively distinguishing event representations according to their source. Further, if autonoesis is not part of the content of the construction, it must be an outcome of second-order processes specific to episodic memory occurring at retrieval (Klein 2013b; Klein & Markowitsch 2015; Wheeler et al. 1997). The mechanisms of episodic retrieval have long been a neglected area of memory research (Roediger 2001). An exception to this

https://doi.org/10.1017/S0140525X17000012 Published online by Cambridge University Press

has been the "source-monitoring framework" by Johnson and colleagues (Johnson & Raye 1981; Johnson et al. 1993). These authors have argued that episodic retrieval involves monitoring processes that determine the source of retrieved information. According to Johnson (2005), episodic memory is in fact nothing but source memory.[5]

A similar perspective has been proposed by Cosmides and Tooby (2000; see also Klein et al. 2004), who argued that the appropriate functional role that a given output of scenario construction ought to play in inference is dependent on its source. This, in turn, necessitates that the contents of the construction be representationally decoupled from their direct relationship to reality. This is accomplished by applying a source tag to these contents, which governs how they can be further used in inference. Indeed, source-monitoring mechanisms seem to fill the role of such decoupling processes; they effectively endorse contents under a given description (Michaelian 2012a; 2012b).

This process, Cosmides and Tooby (2000) argued, is best described as the application of an appropriate epistemic attitude.[6] In the case of episodic memory, the attitude of *remembering* corresponds roughly to the proposition "has been obtained through firsthand informational access." Cosmides and Tooby went on to propose similar attitudes for imagination, planning, and so forth. Of course, attitudes cannot be indiscriminately applied to any content; for example, one cannot remember a future event. However, this proposal makes sense of the fact that the same simulation of a specific past event can both be remembered and imagined. Moreover, because attitudes can be recursively embedded, this view can accommodate the fact that we can (for example) remember imagining. In effect, the processes involved in source monitoring can thus be described as resting on a complex metarepresentational grammar, in which different attitudes, each with their own epistemic status, can be embedded within each other to establish the epistemic status of the construction as a whole.

Crucially, this view preserves the strengths of the minimal view of episodic memory (Russell & Hanna 2012) in accounting for the distinctive phenomenology involved, while also accommodating the intuition underlying self-reflexive views, according to which episodic content is not enough for episodic memory to occur (Klein 2013b). Autonoesis is here taken to be an outcome of the capacity to metarepresentationally embed outputs of the scenario construction system under the epistemic attitude of remembering.

1.1.3. Event memory and episodic memory. Hippocampus-based event constructions do not have to be embedded under a metarepresentational attitude in order to support behavioral decisions. This at least is suggested by findings showing that the hippocampus is implicated in implicit memory tasks (Hannula & Greene 2012; Olsen et al. 2012; Sheldon & Moscovitch 2010). That is, scenarios of specific past events can be represented as having occurred without the attitude of remembering being applied.

Note that *believing* is an epistemic attitude as well, albeit one that does not necessarily require the metarepresentation of its contents. Arguably, we adopt the attitude of believing to semantic memories by default. Thus, if the same attitude is applied to constructed scenarios, we should expect their content to acquire inferential properties similar to semantic information. However, although they do not differ in content (they are about specific past events), believed event simulations are not episodic memories.

Instead, we reserve the term *event memory* for this kind of representation (for similar proposals, see Keven 2016b; Rubin & Umanath 2015). Such event memories might differ from full-blown episodic memories in that they include source information only in the sense of allowing the distinction among different events (Crystal et al. 2013), are not located in subjective time (Nysberg et al. 2010), are not necessarily subject to conscious awareness (Dew & Cabeza 2011; Hannula & Ranganath 2008; Henke 2010; Moscovitch 2008), are not self-referential (Rubin & Umanath 2015), and do not have "narrative structure" (Keven 2016b).

Such a distinction between event and episodic memory is at least tentatively supported by findings from several lines of research. Infants demonstrate some capacity for recalling events (Bauer & Leventon 2013; Mullally & Maguire 2014), but only between the ages of three and five years do children begin to access event information as the source of their beliefs (Haigh & Robinson 2009). Moreover, the outputs of the hippocampus are not necessarily conscious (Henke 2010), but nonetheless inform eye-movement behavior in implicit memory tasks (Hannula & Ranganath 2008). In fact, eye movements can serve as an implicit, veridical index of event memory, which can dissociate from explicit responses (e.g., Hannula et al. 2012). On the side of neuropsychology, the case of RB mentioned above demonstrates that it is possible to lose the capacity to remember events autonoetically without losing the ability to access event information as such (Klein & Nichols 2012).

The concept of event memory thus allows us to take seriously the mnemonic abilities of young children (e.g., Burns et al. 2015; Clayton & Russell 2009; Fivush & Bauer 2010) and nonhuman animals (e.g., Corballis 2013; Clayton & Dickinson 1998; Gupta et al. 2010; Martin-Ordas et al. 2010; 2013; Templer & Hampton 2013) without necessarily attributing to them capabilities for episodic memory in the same sense as human adults possess them (Redshaw 2014; Tulving 2005). Thus, event memory most likely differs in function from episodic memory, and we will focus here on a functional explanation for the latter.

1.2. Remembering and believing the occurrence of past events

One consequence of viewing episodic memory as the outcome of the application of a distinctive epistemic attitude is that remembering has to be distinguished from believing. This might seem counterintuitive because we usually believe whatever we remember. Nonetheless, psychologists commonly distinguish the belief in the occurrence of an event from episodic memory of the same event (Blank 2009; Fitzgerald & Broadbridge 2013; Mazzoni & Kirsch 2002; Rubin et al. 2003; Scoboria et al. 2014). What, then, should we take the relationship between remembering and believing to be?

1.2.1. Epistemic generativity. Crucially, when we remember, we do not simply generate two representations: a belief that the event in question happened and an episodic memory of the event. Instead, these representations are inferentially connected: We take ourselves to have knowledge about the event in question *because* we had firsthand access to it. Perner and Ruffman (1995), followed by

https://doi.org/10.1017/S0140525X17000012 Published online by Cambridge University Press

Suddendorf and Corballis (1997; 2007), took this circumstance to imply that episodic memory requires a form of causal understanding: namely, the capacity to understand that informational access leads to knowledge or belief. They tested this idea by investigating whether there is a correlation between children's episodic memory ability and their ability to infer "knowing" from "seeing." Notwithstanding that Perner and Ruffman did indeed find such a correlation, it seems to us that what is involved in episodic memory is not only a capacity to infer knowing from seeing, but also the ability to further represent the sources of one's own present beliefs *as sources* in the first place (Haigh & Robinson 2009).

As we have argued above, episodic memory in some sense is just a specific type of source memory. When we remember, the content of the memory no longer functions as an event representation but instead as the source of a present belief. Representing the source of a belief requires, but importantly goes beyond, the inferences involved in ascribing knowledge or belief on the basis of informational access. In the latter case, one simply takes note of the fact that a given agent has appropriate informational access to X and, from this circumstance, infers that she now knows X. From the fact that Anna has looked inside the box, Ahmed infers that she knows what is inside it. In the former case, however, one has to additionally represent the inferential relationship holding between the episode of informational access and the knowledge state. In this case, from the fact that Anna looked inside the box, Ahmed infers not only that she now knows what is inside, but also that this is so because she has seen it.

In other words, to represent the source of a given belief requires the representation of the kind of justification that this belief has received. Therefore, in our account, the represented relation between a given past episode of informational access and a given present belief is one of justification. Episodic memory requires the capacity to understand not only that seeing leads to knowing, but further that seeing justifies claims to knowledge.

Another way to frame the distinction between episodic memory, event memory, and semantic memory would thus be according to their respective role in belief formation: In contrast to event memories and semantic memories, episodic memories are not beliefs but, rather, provide grounds for believing. In more technical terms, event memory and semantic memory are *epistemically preservative*: They preserve the original justification of the endorsement of their contents through time. In contrast, episodic memory is *epistemically generative*[7]: It generates present justification for why we should endorse its contents (Burge 1993; Dokic 2001; Matthen 2010). When we remember a given event, the fact that we remember supports our belief that this event indeed occurred insofar as it provides a reason for this belief (Teroni 2014; see also Audi 1995). If you episodically remember that you were walking on the Red Square last August, you believe that this is indeed what you did simply because you remember it. Other types of memory, in this conception, are different exactly because they do not include a justification of their own contents. When we retrieve information non-episodically, we "just know" without also "knowing why we know."[8]

1.2.2. Memory-belief congruency. Remembering and believing thus stand in a relation of justification in which the fact that we remember justifies our beliefs about past events. If this is the case, we might expect the contents of episodic memory to be largely veridical so as to provide normatively appropriate, reliable grounds for our beliefs. In particular, we should not expect our beliefs themselves to have any influence on what we remember.

As illustrated by Neisser's (1981) famous case study of the memory of John Dean, the question of what it means for a memory to be veridical is not a straightforward one. Dean, a former counsel to president Richard Nixon during the Watergate affair, provided testimony that was usually in essence correct but contained many (mostly self-serving) incorrect details. In fact, whether a given memory should be described as veridical might depend on the method used for assessing it (Koriat & Goldsmith 1996a). Consequently, although episodic memory is usually reliably veridical under some descriptions, there has also been a long tradition of research pointing out the fallibility of this system. Starting with Bartlett's (1932) classic treatment, an impressive amount of evidence suggests that the construction process on which episodic memory relies is surprisingly error-prone. Both encoding and retrieval processes typically alter information substantially (e.g., Alba & Hasher 1983; Roediger 1996; Schacter 2001). Crucially, one important line of evidence suggests that beliefs play an unexpectedly large role in the construction of episodic memories (Conway 2005; Ross 1989; Blank 2009). In many situations, construction seems to be guided by one's current beliefs about whatever is to be remembered rather than the memory trace itself. If the construction process underlying episodic memory were indeed optimized to support beliefs about actual occurrences, such a trade-off would be unexpected.

Evidence for top-down influences on episodic memory comes from a range of experiments investigating the effects of post hoc manipulation of participants' attitudes, expectations, or appraisals on their memories. It is usually found in these studies that people remember the past inaccurately but congruent with, and supportive of, their newly acquired beliefs. For example, in a study by Henkel & Mather (2007), participants were asked to make a choice between two options, each of which had an equal amount of positive and negative features associated with it. When asked to remember their choice later, however, participants misremembered the features of the options they chose as more positive than they were (see also Benney & Henkel 2006; Mather & Johnson 2000; Mather et al. 2000; 2003). Crucially, this shift was dependent on what participants believed they had chosen, irrespective of their actual choice (see also Pärnamets et al. 2015). That is, here participants remembered having made a choice they did not actually make (but believed they did) and, additionally, remembered the option they believed they had chosen as having had more positive features than it actually did. In other words, they displayed both memory congruency with the induced belief and a memory distortion supporting this belief.

Similar congruency effects have been found in such diverse domains as memory for emotions (Levine 1997), attitudes (Goethals & Reckman 1973; Rodriguez & Strange 2015), one's own behaviors (Ross et al. 1981; 1983), one's own traits (Santioso et al. 1990), and even one's own clinical symptoms (Merckelbach et al. 2010; 2011). The methods of these studies are diverse, and it is, therefore, unclear to what extent each of these effects is specific to episodic memory.

https://doi.org/10.1017/S0140525X17000012 Published online by Cambridge University Press

Evidence suggesting such specificity, however, is supplied by research on memory manipulation.

There is an impressive literature showing that it is possible to induce in people vivid, detailed false memories, which are subjectively indistinguishable from accurate recollections (Lampinen et al. 1997; Payne et al. 1996). People usually create false or altered memories in response to having changed their beliefs about a given event. This in turn is usually the outcome of having been exposed to persuasive communication (Nash et al. 2015). In fact, persuasion is a main factor in the effectiveness of most memory manipulation paradigms (Leding 2012). This suggests that induced beliefs can guide constructive retrieval.

On the basis of evidence about such belief-memory congruency effects, it seems fair to conclude that retrieval has a tendency to confirm prior beliefs rather than to contradict them. Such evidence then is not easily reconcilable with a view that takes episodic memory to be exclusively aimed at reconstructing events in the way they actually occurred. Rather, these studies show that the episodic construction process seems to just as often be geared toward constructing event representations so as to be consistent with, and supportive of, our prior beliefs. Commonsensically, we would assume episodic memory to be an exclusively belief-forming system. Phenomenologically, it seems to us that we form beliefs about the past on the basis of remembering it, not vice versa. In contrast, research on memory illusions suggests that beliefs about the past and episodic memory are reciprocally interconnected: Sometimes we remember an event because we believe it occurred.[9] And in turn, once we have constructed a memory on the basis of such a belief, the memory itself might serve to strengthen the belief that induced it.

Crucially, this does not mean that episodic memory is not commonly veridical. In fact, the effects of prior beliefs and attitudes on subsequent memory seem to be highly context dependent (e.g., Eagly et al. 2001). Veridicality in episodic memory construction is not an all-or-nothing affair. Instead, retrieval processes seem to aim to strike a balance between congruency with memory traces, on the one hand, and belief justification on the other. However, such a balancing act is not always possible. In some such cases, then, remembering an event will lead to belief revision, whereas, in others, believing that an event occurred will lead to the construction of an event simulation without a corresponding trace.

1.3. The features of episodic memory

We are now in a position to specify the features of episodic memory that any functional account should be able to account for. Episodic memory consists of an epistemic attitude taken toward the simulation of a specific past event, which serves to justify a belief about the occurrence of this event. We are thus in agreement with Klein (2015b), who similarly argued that episodic memory is not individuated through its contents alone but rather through the manner in which this content is made available. More formally, episodic memory is

1. Quasi-experiential

The representation is an outcome of scenario construction: It includes spatiotemporal structure, perspectivity, and modality-specific sensory information.

2. Event specific

The representation is specific to a single spatiotemporal context.

3. Past-directed

The event in question is represented as having occurred in the past.

4. Autonoetic

Event information is (meta-)represented as having been obtained firsthand.

5. Epistemically generative

The memory is not represented as a belief but as providing grounds for believing.

Importantly, we take these features to be individually necessary and jointly sufficient for episodic memory to occur. Thus, because episodic construction is congruency prone is not necessary to episodic memory, we did not list it as a separate feature here. Nonetheless, as we will argue below, we take congruency proneness to be a functional property, that is, a feature rather than a bug of this system. Moreover, we can separate this list of features according to which properties pertain to the content versus the format of episodic memory. Whereas features (1) through (3) pertain to the content (and should thus be shared with event memory), (4) through (5) pertain to the format of episodic memory. The differences between the different kinds of memory capacities discussed above are illustrated in Table 1.

2. What is episodic memory for?

Adaptive function cannot be discerned by merely asking what a given cognitive ability is useful for (Millikan 1984; Sperber & Hirschfeld 2004): One can use a pair of scissors as a paperweight, but that does not allow one to infer that scissors are designed for keeping paper from flying away. Rather, to arrive at an estimation of proper function, one needs to identify a fitness-relevant problem, which the mechanism under consideration will solve more efficiently than comparable, cheaper alternatives. This then allows one to infer that the capacity in question has been retained in the selection process because of its differential contribution to the solution of said task.

Applied to the current context, the question is, therefore, what fitness-relevant problem is solved by an autonoetic

Table 1. *Different representational features of episodic memory, event memory, and semantic memory.*

Memory type	Quasi-experiential	Event-specific	Past-directed	Epistemically generative	Autonoetic
Episodic memory	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**
Event memory	**Yes**	**Yes**	**(Yes)**[10]	**No**	**No**
Semantic memory	**No**	**Not necessarily**	**Not necessarily**	**No**	**No**

https://doi.org/10.1017/S0140525X17000012 Published online by Cambridge University Press

and epistemically generative memory system for past events (episodic memory) that could not be solved by a memory system without these features (event memory)?[11]

2.1. Future-oriented mental time travel

Information about the past is important only insofar as it enables us to make better decisions in the present so as to ensure benefits in the future (Klein et al. 2002a). Some authors have taken this constraint very literally, viewing episodic memory as part of a wider system that has evolved to enable us to mentally travel into the future (Michaelian 2016a; Schacter & Addis 2007; Schacter et al. 2007; Suddendorf & Corballis 1997; 2007). The proponents of this view deliberately frame their account in terms of mental time travel, as they view the abilities of constructing the personal past and the personal future as two sides of the same cognitive system. In this view, the capacity for episodic memory is just one instantiation of a wider ability to construct scenarios in time, the function of which is taken to be planning for and thinking about the future.

Support for this mental time travel account comes from neuropsychology and cognitive neuroscience. On the side of neuropsychology, it has been found that patients with hippocampal lesions often (not always: see Maguire et al. 2010) lose not only the ability for episodic memory, but also the ability to imagine their personal future (Klein et al. 2002b) and to imagine counterfactual scenarios (Hassabis et al. 2007a). On the side of cognitive neuroscience, functional neuroimaging studies have shown the activation of a common brain network when participants were engaged in past- or future-oriented mental time travel (Addis et al. 2007; Okuda et al. 2003).

From these findings, some authors have concluded that episodic memory and episodic future thinking (Atance & O'Neill 2001; Szpunar 2010) draw on the same underlying cognitive process and must therefore have evolved for the same reason: to imagine the future through constructively making available elements of the past, which can be flexibly recombined in the service of simulation (Schacter & Addis 2007; 2009; Suddendorf & Corballis 2007). That is, because the future is what determines whether one will live to procreate, this aspect of mental time travel should arguably be what caused humans to retain and develop an episodic system over evolutionary time.

2.1.1. Mental time travel and constructiveness. This view is usually presented as having the advantage of being able to explain the constructive character of episodic memory: Imagining the future requires flexible recombination of stored event information. Given that, in this view, selection of this system has been driven by the future-directed aspect, the past-directed counterpart must be similarly constructive. This line of reasoning is thereby thought to explain the myriad ways in which our reconstructions of the past are error-prone: Selection has simply not optimized this system to represent the past accurately.

This account of constructiveness is, however, problematic, because it leaves us without an explanation for why we should ever be able to reliably and veridically recall past events. If evolutionary selection merely constrained our ability to mentally travel in time insofar as it was useful for simulating the future, remembering the actual past should be accidental. The future is not just a replay of the past, and to assume so would leave us unable to predict events based on new contingencies. We take it that the volatility of the future is exactly why this account is attractive as an explanation of the constructiveness of episodic memory. Episodic memory is, however, also reliably veridical in many cases; a fact that becomes mysterious in this view.

2.1.2. Remembering the future. One might posit that recollection of the actual past would be helpful for imagining the future: Our simulations of the future could be enhanced if we remembered the past first (Szupnar & McDermott 2008a). Selection then might have ensured veridicality in episodic memory because of the benefits an accurate representation of the past provides for our understanding of the future. To be sure, in order to imagine the future, it is important to retain information learned in the past because this will highly constrain any inference as to what might happen in the future. However, it is not clear what re-experiencing the past episodically does for simulating the future, or how it would contribute more to future planning than what semantic memory, extracted from past experience, could supply. As emphasized above, episodic memory is not identical to stored information, and mentally traveling back to the past will not itself include any information about the future.

In fact, if past- and future-directed mental time travel operate over the same type of content and merely differ in the temporal orientation they assign to their constructions, it is not clear why one would need the past-directed aspect at all to imagine the future. To see this, note that inferring what might happen in the future on the basis of an episodic memory is not the same as mentally traveling into the future in the sense required here. Suppose that, the last time you were at the swimming pool, there was a long line at the entrance. When planning to go to the swimming pool the next time, you might recollect this fact episodically and infer from this that there will likely be a long line again this time. Future-oriented mental time travel, however, is not the outcome of an explicit inference of this kind. Instead, in this case, when you ask yourself whether you should go to the swimming pool today, you might imagine that there will be a long line. Of course, the reason that this piece of information might be included in your imagination of this scenario might lie in the fact that there was a long line last time you were there, and you might even be able to infer this from your imagination. Crucially, however, there is no need for you to represent this when constructing your future swimming pool scenario.

It is thus telling that past- and future-directed mental time travel can be dissociated in episodic amnesia (Maguire et al. 2010; Schacter et al. 2012). The loss of the capacity for episodic memory alone does not significantly impair people's ability to draw inferences about the future. Episodic amnesiacs are not stuck in time: They understand what the future is (Craver et al. 2014b), can make future-regarding decisions (Craver et al. 2014a), and show normal discounting of future rewards (Kwan et al. 2012). The claim that we can remember the past in order to imagine the future, then, seems unlikely to be true.

2.2. Source monitoring as a way to guarantee reliability

One way to reconcile the claim that scenario construction evolved to simulate future states of affairs with the fact

https://doi.org/10.1017/S0140525X17000012 Published online by Cambridge University Press

that episodic memory is nonetheless reliably veridical has been to posit post hoc monitoring systems operating over retrieved content (Michaelian 2012a; 2012b; 2016a). Michaelian[12] has proposed that, because selection has not optimized the construction process to accurately represent the past, such accuracy must be ensured post hoc. Because, in large part, the accuracy of our memories depends on their source, and episodes do not include a source tag specifying their origin, the source has to be inferred by monitoring mechanisms at retrieval. Without such mechanisms, the argument further goes, episodic memory would be too unreliable to be useful. Although this assessment is certainly plausible as an account of how episodic memory serves as source memory, it does little to put worries about its reliability to rest. The questions we have raised about veridicality are not issues about source information but rather about the reliability of the construction process itself.

Further, from an evolutionary perspective, if a mechanism carries out its function unreliably, we should expect selection to act on the workings of this mechanism itself rather than producing an additional, expensive, second-order monitoring process. In fact, it is not clear in general why second-order processes would help if we cannot expect certain first-order processes to be reliable. After all, why should the second-order process be expected to be any more reliable? As Kornblith (2012) has pointed out, the assumption that reflection can serve as a way to ensure the reliability of our first-order beliefs generally leads to an infinite regress simply because reflection cannot guarantee its own reliability (see also Mercier & Sperber 2011).

2.3. Episodic memory as an epiphenomenon

It seems that the mental time travel account, with its focus on the construction process, is by itself unable to explain episodic memory. As Klein (2013a) has argued, future-oriented mental time travel differs from episodic memory in important respects. We have argued in section 1.1.3 that episodic memory is decidedly not identical with the outputs of scenario construction. Indeed, Cheng et al. (2016) have pointed out that autonoesis is not necessary for mental time travel to occur (see also Michaelian 2015).

Admitting that episodic memory and mental time travel into the future are importantly different, a proponent of the mental time travel account might say that the ability to mentally travel into the future simply entails the ability to travel into the past as well. In this view, the subjective past is a by-product of representing subjective time at all, which in turn, would be an outcome of a selection process driven by the benefits of imagining the future. Episodic memory would then turn out to be an epiphenomenon of our ability to mentally travel into the future.

This eventuality, however, seems equally unlikely. For one, the evidence cited above shows that one can retain a sense of the subjective future without the subjective past. If our ability to traverse the subjective past was simply a necessary consequence of our ability to imagine the subjective future, this should not be possible. Moreover, the subjective past and subjective future play entirely different roles in our inferences and actions. When you remember, for example, that there was an earthquake in your street last year, it simply does not have the same cognitive consequences as imagining that there might be an earthquake in your street at some point in the future. From this insight alone, we should expect that episodic memory and episodic future thinking should play different roles in our cognitive ecology and subsequently be subject to different selection pressures.

In sum, it might well be that thinking episodically about the future and the past share many similarities because they operate over the same type of content (i.e., event simulations). This fact alone, however, does not explain why we have the ability to do both.

3. The communicative function of episodic memory

We now propose a novel account of episodic memory function in two steps. First, we address the format of episodic memory by providing an explanation of its epistemic generativity, autonoetic character, and proneness to belief congruency (sects. 3.1, 3.2, and 3.3). In a second step, we briefly address the question of why such a capacity is required for the representation of specific past events; that is, we address the content of episodic memory (sect. 3.4).

As discussed above, we take episodic memory to play a generative role in the formation of our beliefs. To get at the proper function of this capacity, let us first consider why it should be necessary to represent our own reasons in support of our beliefs to ourselves. One answer to this question has been provided by Cosmides and Tooby (2000): Reasons delineate the conditions under which we should revise the beliefs we formed on their basis. Explicitly representing the reasons for every piece of endorsed information we hold, however, would be both unfeasible and unnecessary. It would be unfeasible because it would require that we store the causal history of any and all inferences we draw, which would call for indefinite storage and computational capacity. And it would be unnecessary because mechanisms of belief updating can be implemented in a manner for which explicit representation of reasons is not required (such as Bayesian belief updating).

Therefore, commonly we simply store the outcome of our inferences and discard the history of the inference itself. However, as Cosmides and Tooby (2000) also pointed out, a domain in which reasons are regularly useful is the realm of human communicative interactions. Humans rely on communicated information to an extraordinary extent. Such reliance, however, comes with challenges that necessitate the development of dedicated cognitive machinery. Part of this machinery is the handling of reasons (Mercier & Sperber 2011; 2017).

Most forms of communication are cooperative and, as such, are subject to the same evolutionary stability constraints as cooperation more generally (Tooby & Cosmides 1992). Communicative exchange of information is beneficial for speakers insofar as it enables them to influence their listeners' mental state. Conversely, listeners benefit from communication to the extent that they can distinguish reliable from unreliable signals in order to acquire useful information (Dawkins & Krebs 1978; Krebs & Dawkins 1984). As such, communication systems can only survive in the selection process if there is a way to ensure that engaging in information exchange remains beneficial for

https://doi.org/10.1017/S0140525X17000012 Published online by Cambridge University Press

both parties. On the one hand, if there were no way to ensure that signals were reliable (in the face of possible deception and incompetence), then listeners would soon stop paying attention to them. On the other hand, if speakers had no way of influencing their listeners' mental state effectively and to their benefit, they would stop sending messages (Sperber 2001).

On this basis, Sperber et al. (2010) argued that we should expect humans to have evolved a suite of capacities that let us – as receivers – scrutinize communicated information for its veracity through assessing both its content and its source. The mechanisms allowing us to do this are collectively referred to as *epistemic vigilance*. These capacities are thought to provide us with the means to avoid being misinformed either through an interlocutor's incompetence or deceptive intent. Conversely, speakers should be endowed with capacities allowing them to effectively influence their interlocutors. According to Mercier and Sperber (2011; 2017; Mercier 2016) one way this capacity manifests itself is in our ability for reasoning. Reasoning allows us to argue for why others should accept whatever we are claiming by providing reasons for it. Note that this entails that epistemic vigilance and our ability to overcome such vigilance must be reciprocally interconnected. The better listeners are at scrutinizing communicated information, the better we should expect speakers to be at convincing their interlocutors, and vice versa. Reasoning serves both to maximize the persuasive effects of one's message as well as to scrutinize the validity of the content of received messages. Moreover, one way a speaker might maximize the persuasive effect of her message would be to turn her epistemic vigilance against herself so as to simulate the likelihood that an interlocutor would perceive her intended message as valid. When we reason privately, we in effect anticipate having to convince others. This picture suggests that we should be able to produce reasons for our own beliefs and be sensitive to the quality of the reasons others provide for their assertions.

Communication, then, is clearly a domain where having explicit access to reasons is indispensable (for a thorough analysis of this claim, see Mercier & Sperber 2017). In virtue of episodic memory's generative role in belief justification, we might therefore expect it to it play a crucial role in enabling certain kinds of justificatory reasoning, on the one hand, and supporting epistemic vigilance on the other.

3.1. The negotiation of epistemic authority

Reasons, if we are to identify them as such, are metarepresentational. Taking p as a reason for q requires more than representing p and inferring q from it: The fact that p and q stand in a relation of justification must also be represented. Reasoning, then, is the activity of handling inferences in a way that explicitly represents the justificatory relationships holding between different representational contents. Note that it is not essential that a justificatory relationship actually obtains. Rather, what matters is that such a relationship is represented. You might be wrong in taking the fact that (1) you cannot see beyond the horizon to be a reason to believe that (2) the earth is flat. However, this might not stop you from taking (1) to be a reason for (2). According to the argumentative theory of reasoning, the capacity for representing reasons evolved not because it helps us to draw better inferences but to enable us to make others draw the inferences we want them to draw – that is, to convince them, as well as to evaluate others' reasons (Mercier & Sperber 2011).

As we have argued above (sect. 1.2), when we remember, we represent to ourselves why we believe certain things about the past. In other words, we represent to ourselves the justificatory relationship between the source of our belief and the belief itself. This is not to say that our beliefs are exclusively justified in this way. Not all of our beliefs are such that they could be appropriately justified through recollection. Nonetheless, there is a large range of beliefs for which knowing that one remembers is a good reason to hold them.

3.1.1. Remembering as a reason for others. But how could the fact that one remembers serve as a reason for others to believe a given assertion? Note that, in cases where minimal mutual trust between interlocutors can be assumed, it is indeed the case that "remembering" is generally taken by others to be a reason for accepting certain claims. Consider the following situation: John and Jenny are on a walk when Jenny expresses that she is worried that they might have left on the oven at home. To this John replies, "Don't worry, I remember that we turned it off." Why should the statement that John remembers here be any more reassuring than simply stating: "Don't worry, we turned it off"? Here, "I remember" serves as a reason for Jenny to accept John's statement just as it serves as a reason for John to indeed believe that the oven was turned off.

Now, clearly remembering does not work as a reason here in the same way as an argument does. Instead, we can get a clearer sense of the work such autonoetic claims do in interlocution by taking a closer look at the pragmatic structure of testimony. Testimony entitles an interlocutor to take whatever is conveyed as true on the authority of the speaker. This entails that by giving testimony, the speaker herself has to take responsibility for the truth of whatever is stated (Brandom 1983; McMyler 2007; Turri 2011). In the case of secondhand testimony, one can defer this responsibility, but only insofar as one can actually access the source of the information in question.

Indeed, Nagel (2015) has recently argued that our propensity to represent the ways in which our epistemic states are grounded through source monitoring relates exactly to this circumstance. She observes that the different sources of belief we intuitively take to hold epistemic warrant do not regularly coincide with actual differences in reliability: An expert judgment received through testimony, for example, might well be more reliable than what one has concluded on the basis of one's own perception. It thus seems unlikely that source monitoring would serve a purely epistemic function. Instead, Nagel observed, "source monitoring matters when we need to communicate our judgments to others: indeed, even to decide what does and does not need to be conveyed, it matters where our judgments are coming from, and where our evidence is situated, relative to ourselves and our audience" (p. 301). In fact, the ubiquity with which source information is useful in communication has arguably led to its grammaticalization in about one quarter of all known languages as evidential markers (Aikhenvald 2004; Speas 2008). The distinction

https://doi.org/10.1017/S0140525X17000012 Published online by Cambridge University Press

between indirect and direct forms of evidence seems to be common to all evidential systems.

This begins to make sense of the question of why episodic recollection comes with a representation of its own origin. In this view, autonoesis is the capacity that enables us to distinguish between cases in which we can assert epistemic authority for our own testimony and cases in which we cannot. Note that even in cases where one defers to someone else, one will have to take responsibility for the very act of doing so. If Hanna tells you, "Mary told me that Mark was not at the party yesterday," while Hanna does not take epistemic responsibility for whether Mark was indeed at said party, she does take responsibility for the fact that Mary told her that he was not.

One reason for why it is important to monitor which assertions we can commit to in discourse is reputational. If we discursively commit to, and thereby allow others to rely on, the truth of an assertion, we take responsibility for its truth, and thereby put our reputation as a reliable informant on the line. Thus, discursive commitment comes at a potential (direct or reputational) cost in case our message is found to be unreliable. For our interlocutors, the fact that we are willing to incur such a cost is a reason to believe us. Through this dynamic, as Vullioud et al. (2017) have recently argued, discursive commitment is a way to stabilize communication. Claims to remembering, then, do not offer a way of overcoming skepticism in the same way as argumentation proper does.[13] Instead, it is an issue of competence: Episodic memory allows us to signal to others that we indeed have epistemic authority on a certain matter, which in turn commits us to our message, and this should cause others to believe us.

In fact, it is hard to see how else one would argue about certain past events. When it comes to the past, sometimes epistemic authority is all we have to go on when deciding what to believe. Indeed, young children preferentially endorse the testimony of informants who had firsthand informational access (Terrier et al. 2016), and Castelain et al. (2015) showed that young Maya children are more likely to endorse the testimony of a source claiming to have epistemic authority ("The hen went this way because I have seen it") over a source giving no reason, even when it conflicted with another cue usually governing such endorsement (power).

Of course, episodic memory is not the only device allowing us to regulate our communicative commitments. Markers of confidence seem to be another one (Vullioud et al. 2017). Episodic memory is simply the mechanism specifically geared toward regulating communication about past events. Therefore, communicatively negotiating the past often becomes a matter of convincing one's interlocutor that one remembers: that is, that one has epistemic authority on the matter in question. Because remembering is such an effective way of asserting epistemic authority, it might be beneficial to attribute the origins of (at least certain types of) event information to our own experience in situations in which this would be communicatively useful. This might explain some occurrences of the famous misinformation effect (Loftus 2005). Here, witnesses have been found to persistently over-attribute misleading information acquired about an event after its occurrence (post-event misinformation) to their experience of this event. From the perspective we have proposed here, this might simply be the best way to make use of this information in appearing as a good witness. After all, if the participants in these studies believed the misinformation to be correct (as they seemed to do), they must have experienced the event in this manner, too.

Going further, this analysis also reveals a functional aspect of the fact that episodic recollections are often rich in contextual details. Although event memory should similarly be characterized by the availability of contextual details, these details play a functional role for communicative purposes in episodic memory. When we debate a past event, the fact that we can produce rich, detailed descriptions serves as evidence for others – as it does for ourselves, too (Johnson & Raye 1981) – to believe that we are indeed remembering (Bell & Loftus 1988; 1989). The reason for this effect of detail might be that contextual details (1) give one's interlocutor more leverage to detect potential inconsistencies and reduce vagueness (Kraut 1978), as well as (2) supply information that might potentially be independently verified. For example, information about the location and co-witnesses of an event makes it possible to potentially obtain evidence about the event that is not dependent on the testimony of one's immediate interlocutor. Such independent verification will, in practice, often not be carried out. Instead, it might be enough that an interlocutor is willing to make her account subject to such verification, which is taken as a reason to accept her testimony. Consequentially, contextual elements that, at least potentially, make verification possible might be more readily available in recollection simply because this information should allow one to be perceived as more convincing. When we argue about the past, we often do not contest whether the event in question happened, but rather in what way it did, and having access to contextual details is often crucial to establish which of multiple accounts of an event should be endorsed and what it should be taken to entail.

3.1.2. The consequences of discursive commitment.

Another prediction following from this account concerns the fact that once one has publicly committed to, and therefore taken epistemic responsibility for, the truth of a certain version of events through testimony, this should have subsequent consequences on how and what one remembers. On the one hand, after testimony, it becomes less important to recall the actual event. Instead, to uphold one's commitment, maximize believability, and avoid reputational damage through inconsistency, one should stick to one's own account to a certain extent. In cases where one's account of an event and the actual happenings diverge, one might thus subsequently remember the event in question in a way that supports one's report. A range of memory distortion effects occurring as a consequence of memory report suggests that this is indeed what happens. For example, Cochran et al. (2016) investigated the effect of altering participants' memory reports on their memory for crime events. They found that participants often did not detect the changes to their reports and instead altered their memories to fit the manipulated reports. Tversky and Marsh (2000) found that the public stance one takes on a past event biases recall to emphasize details supporting one's claim (see Higgins & Rholes, [1978] and Greene [1981] for related effects). This stance, in turn, has been found to depend on one's particular audience (arguably serving both reputation

https://doi.org/10.1017/S0140525X17000012 Published online by Cambridge University Press

management and making one's own memory report easier to accept for others), further altering memory (Echterhoff et al. 2008; 2009b; Kopietz et al. 2009; Pasupathi et al. 1998). In effect, after having reported an event, people subsequently do not recall the original event but rather a version in line with their latest retelling of it (Marsh 2007).

The extent to which such distortions would be communicatively useful should be constrained by how skeptical and informed one's audience is. People should be sensitive to the costs of being found wrong, and appropriately adjust the extent to which they prioritize consistency with their own account over accuracy. Thus, the distorting effects of giving testimony might be mediated by how skeptical and informed one perceives one's audience to be. To our knowledge, this prediction has not been tested.

On the other hand, commitment to one's testimony should cause one to be less easily convinced of a different version of occurrences, given that this would undermine one's own epistemic authority. Indeed, participants' susceptibility to social influence has been found to depend on whether they had committed in one way or another to certain details of an event (Bregman & McAllister 1982; Loftus 1977; Schooler et al. 1988). The reason for this cannot be simply epistemic, because in general, participants have been shown to be quite ready to update their memories on the basis of others' testimony. Instead, our account suggests that participants in these studies became resistant to social influence in order to ensure their own believability.

3.1.3. Recollective my-side bias. Being able to convince others that we are indeed remembering is only important insofar as it helps us to convince them about *what* we are remembering. The contents of our memories are crucial for supporting certain conclusions over others when it comes to the interpretation of what a given event entails. Thus, if episodic memory indeed has the communicative function of appropriately asserting epistemic authority about the past, we should expect it to make content available in a way that supports our claims.

Mercier and Sperber (2011) have argued that because the production of reasons does not serve normative epistemic goals but is meant to convince others, it should primarily find reasons in favor of whatever we want to claim. Their view predicts the well-known my-side bias in reasoning: the human tendency to reason from conclusions to premises, and not vice versa as normatively required. By analogy, when we claim that episodic memory is crucial for persuading others of a particular version of the past, we should similarly expect such a bias in remembering: To be able to argue for our beliefs about a past event, our recollections should tend to support those beliefs instead of contradicting them.

Indeed, such a recollective my-side bias is instantiated through the way in which our beliefs guide the construction of memory content. Similar to confirmatory reasoning, belief-guided memory construction (reviewed in sect. 1.2.2) can be taken to be a version of the my-side bias to the extent that one constructs a memory justifying what one already believes to have happened. Understanding memory reconstruction as an instance of my-side bias for the purposes of persuasion can make sense of the surprising interplay between beliefs and memory content: The constructive process tends to retrospectively create memories confirming and supporting held beliefs and attitudes. From this perspective, such false memories are simply the results of an inherent tendency to justify our beliefs about the past to ourselves in order to be able to justify them toward others; they illustrate a functional feature, rather than a bug in, the mechanisms of episodic memory. Thus, inducing beliefs about the past in participants is followed by false memories, because once we have accepted a piece of information, justifiability is ensured through the construction of supporting memory content.

Of course, if we are correct, there should be limits to this form of my-side bias. If the costs of being found wrong are high, or our audience can monitor our assertions effectively, we ourselves should be more skeptical toward the outputs of our own construction system (i.e., put more effort into checking their consistency) and consequently be less likely to form a false memory.

3.1.4. Selective remembering and motivated forgetting

A similar analysis can be applied to phenomena described under the heading of "motivated forgetting" (Anderson & Hanslmayr 2014). Motivated forgetting describes a process by which selective or inhibited retrieval leads to forgetting of aspects of (or entire) events. People tend to selectively remember arguments in favor of an endorsed conclusion or attitude while forgetting counter-arguments against the same conclusion or attitude (Waldum & Sahakyan 2012). This process has been shown to be especially prevalent in the domain of moral violations. In fact, memories of one's own moral violations are more likely to be forgotten than memories of one's own moral behavior, so that people sometimes seem to display a form of "unethical amnesia" of their past (Kouchaki & Gino 2016). In contrast, Bell et al. (2014) have shown that memory for the cheating behavior of *others* is well remembered when it is associated with personal costs but easily forgotten when associated with personal benefits. These processes lead to the phenomenon of rose-colored memories, which emphasize one's own moral character. Given the importance of episodic memory for the communicative negotiation of the past, such effects are not surprising. Both on the individual (Kappes & Crockett 2016) and the collective level (Coman et al. 2014), selective remembering and motivated forgetting serve communicative ends: Convincing oneself simply helps to convince others (von Hippel & Trivers 2011).

3.1.5. Remembering reasons. As we noted in section 1.1.2, taking remembering to be an attitude makes intelligible how one can remember imagining, believing, wanting, and so forth. In our view, this makes sense insofar as the process of retrieving reasons via introspection in many cases amounts to an attempt at remembering these reasons. To see this, consider Johansson et al.'s (2005) famous choice blindness experiments (for a higher stakes example, see Hall et al. 2012). In a series of two-alternative, forced-choice trials, participants were asked to choose, between two faces, the one they found more attractive. After answering, participants were presented again with the chosen face and asked to explain why they had chosen this face. Crucially, in a certain proportion of trials, the experimenter switched the presented face by sleight of hand so that the participant was now presented

https://doi.org/10.1017/S0140525X17000012 Published online by Cambridge University Press

with the face they had not chosen. In this situation, not only did a substantial number of participants not notice the change, but they also went on to give reasons for why they ostensibly had chosen the face presented to them. How did the participants come up with reasons for a choice they had not made in this situation? Clearly, they must have constructed these reasons on the fly in response to being asked to justify their choice. Crucially, however, because the participants did not notice that they were justifying a choice they had not made, they presumably believed that the reasons they gave were actually the reasons that had guided their (imagined) original choice. The only way, however, this is possible is if the participants sincerely believed that they *remembered* these reasons. This kind of post hoc generation of memories is often required when we genuinely give reasons for our behavior after the fact. In this way, the attitude of remembering is crucial to introspecting our own past reasons.

3.1.6. Source monitoring as self-directed epistemic vigilance. As mentioned above, epistemic vigilance and the mechanisms designed to disarm such vigilance are essentially two sides of the same coin. The easiest and most effective way to anticipate one's interlocutor's vigilance might be to exercise such vigilance against one's own assertions before uttering them. Source monitoring, as described by Johnson et al. (1993), displays just such a structure. Michaelian (2012a; 2012b) noted that source-monitoring mechanisms are endorsement devices: They decide to what extent we should believe the contents of our own recollections by scrutinizing them for their believability, just as others do when they hear our testimony. These endorsement mechanisms might then be one way in which we can gauge whether we should indeed commit to a certain claim about the past or not. Although Johnson et al. (1993) seem to have assumed that source monitoring is purely epistemic in function and compulsory in event recall, it might well be that these processes are only applied in situations in which scrutiny is required: situations in which one expects to face a (skeptical) audience.[14]

3.2. *Supporting epistemic vigilance*

Source monitoring does not just serve to anticipate others' vigilance but also functions to exercise vigilance against others. This is borne out by the fact that children become increasingly less suggestible as a result of source memory development (e.g., Bright-Paul et al. 2005; Giles et al. 2002; Lampinen & Smith 1995). Having access to the sources of our beliefs allows us to keep track of the sources of transmitted information and scrutinize such sources for their competence and intentions.

3.2.1. Source-directed epistemic vigilance. Similar to our account, researchers (Boyer 2009; Cosmides & Tooby 2000; Klein et al. 2002; 2009;) have emphasized the role of episodic memory in epistemic vigilance. In their view, the fact that humans so excessively rely on communicated information has necessitated a mechanism allowing us to adjust the truth value of our beliefs according to their source. To decide whether an interlocutor is trustworthy, or whether to re-evaluate such trust, it is necessary to have access to her past behavior in specific situations. When we learn new information about an interlocutor's reliability after the fact, it is important to have access to our interaction history with this specific person to be able to re-evaluate any pieces of information we might have received from her. The importance of source monitoring in such situations is showcased in misinformation studies, in which participants are able to recover their original event representation when they are informed of the deceptive character of the misinformation (Blank & Launay 2014; Echterhoff et al. 2005; Oeberst & Blank 2012). However, as evidenced by the mediocre effectiveness of most post-warnings, episodic memory seems to be rarely used in this way. Most of the time when we are informed that a given source is untrustworthy, we merely discount this source in the future. Nonetheless, as predicted by our account, encoding is mediated by epistemic vigilance toward the source of information: Misinformation and conformity effects are not automatic but rather depend on participants' evaluation of their own confidence and the reliability of the source of the presented information (Allan et al. 2012; French et al. 2011; Gabbert et al. 2007; Jaeger et al. 2012; Lindsay & Johnson 1989). When participants have reason to doubt their own (Asefi & Garry 2003; Clifasefi et al. 2007) or others' ability (Kwong See et al. 2001) or trustworthiness (Dodd & Bradshaw 1980), they refrain from memory update. In such cases, rather than simply updating their own event representations on the basis of others' testimony, participants encode it in a separate trace (Ludmer et al. 2015).

3.2.2. Interpersonal reality monitoring. The two-sided nature of vigilance and counter-vigilance is illustrated in another aspect of recollection. In deciding whether someone is telling the truth in recounting the past, we usually try to determine whether our interlocutor is remembering or making up the contents of her testimony. Research in the tradition of the source-monitoring framework has investigated how we make this decision about ourselves through so-called reality-monitoring mechanisms (Johnson 1991; Johnson & Raye 1998).

Apart from allowing us to determine whether we should take ourselves to be actually remembering, reality monitoring could play a role in making this decision about others, too. That is, to decide whether we are remembering or imagining a given event, we might use the same mechanisms that are charged with this decision when evaluating others' testimony. This is suggested to some degree by studies on interpersonal reality monitoring – the ability to judge whether other people's memories reflect real or imagined events (Johnson et al. 1998; Johnson & Suengas 1989). These studies suggest that participants use the same criteria to evaluate their own memory content and others' memory accounts, and can display above-chance discrimination performance in such situations (Clark-Foos et al. 2015). Note, however, that this is not a matter of detecting outright deception but rather one of deciding whether we should grant our interlocutor epistemic authority. In detecting deception, we likely use other mechanisms to assess others' intentions, which in turn might influence our reality-monitoring decisions.

3.2.3. Veridical recollection and epistemic vigilance. Viewing episodic memory as striking a balance between

https://doi.org/10.1017/S0140525X17000012 Published online by Cambridge University Press

the productive and receptive sides of communication can make sense of the confusing interplay between veridicality and malleability, described in section 1.2.2. Similar to reasoning (Mercier & Sperber 2011), the evolution of episodic memory should have been subject to an "arms race" between senders and receivers of communicated information about past events. Whereas senders have an interest in inducing in their audience a representation of the past that is to their benefit, receivers are interested in acquiring useful (i.e., true) information. Thus, the better senders should be at manipulating their audience's beliefs about the past to their own benefit, the better receivers should be at discerning true from misleading information. Both sides of this interaction therefore require the capacity to represent the past accurately.

On the one hand, if episodic memory were never true, it would not convince anyone.[15] Thus, speakers should be sensitive to how informed and skeptical their audience is and consequently be more careful about what they commit to (i.e., exert more effort in checking their own memory representation for its believability). Receivers, on the other hand, should be sensitive to the interlocutor's intentions and (if available) spend more cognitive resources to monitor the believability of her utterances.

Thus, the epistemic vigilance functions of episodic memory coincide with the epistemic route from memory content to belief: We are able to form and revise beliefs on the basis of episodic recollection because this enables us to guard against others' incompetence and deceptive intent in communicative interaction. This perspective then gives us an explanation for why (and when) we should expect episodic memory to be veridical: Epistemic vigilance requires sensitivity to the actual past to enable us to review others' claims and decide when to revise our own beliefs on the basis of such claims. Moreover, the fact that we can expect others to be vigilant, and as such sensitive to the truth, should force us to stick to actual events to the extent that others can monitor us in communicative interaction. Thus, the construction process in episodic memory should be sensitive to the communicative situation we find ourselves in. In cases in which we face a skeptical audience, which raises the costs of being found unreliable, or when we are scrutinizing someone else's claims on the basis of our own memory, construction should aim at accurate event representation.

3.3. Episodic memory format explained

Taking a perspective from human communication on episodic memory can illuminate its format in a functional light. Here we summarize the above discussion in terms of how we have made sense of the features pertaining to the format of episodic memory identified in section 1.3.

1. *Epistemic generativity* allows us to (meta-)represent the reasons for our beliefs about past events so that we can give these reasons in testimony.

2. *Autonoesis* delineates those of our claims about the past for which we can assert epistemic authority.

Beyond the above features that discriminate episodic memory from event memory, our analysis also accounts for why episodic memory is simultaneously congruency prone (risking to be false) and aiming at veridicality. The fact that scenario construction is congruency prone allows us to effectively argue for those beliefs we already hold. Nonetheless, episodic memory is commonly veridical because it serves a role in epistemic vigilance, which requires some degree of sensitivity to actual occurrences.

3.4. Past events as reasons

Our account so far has focused on the structural features of episodic memory. But what arguably is at stake in an explanation of episodic memory function is not only its metarepresentational nature. After all, these are aspects shared with many other aspects of cognition supporting human communication (Mercier & Sperber 2017). What makes these features interesting is rather the content to which they pertain in episodic memory: specific past events. The question that we have yet to answer is why such a representational structure should be necessary for this content in particular. Why did humans develop a specific mechanism regulating their communicative commitments about past events? Why would we ever want to convince others about a particular version of history, and why do we care what others assert about the details of events they experienced in the past? Although a full treatment of this question would exceed the boundaries of the current article, we provide here a short attempt at one potential answer, without claiming that it exhaustively accounts for all examples of the human obsession with the past.

3.4.1. Remembering events generating social commitments. Because knowledge about specific events can be critical in assessing the truth of certain generalizations, their recollection can also be crucial in supporting the communicative assertion of many such generalizations ("I remember seeing him beating his wife, therefore he must be an aggressive person"). In principle, any inductively derived conclusion can be supported or undermined by pointing to specific events. Nonetheless, reference to past events is not mandatory in arguing for inductive generalizations. In principle, one can argue for such assertions by pointing to other generalizations one holds true as well.

There are, however, certain claims for which it is impossible to argue except by reference to specific past events: namely, the assertion of social commitments. Examples of such events are agreements between multiple parties that commit one or the other interactant to a certain behavior in the future (Schelling 1960). But these are by no means the only examples; potentially, any event can be used to establish social commitments or entitlements depending on what interpretation one chooses after the fact. Indeed, most events that happen to us on a daily basis are heavily loaded with social meaning, which largely depends on their potential to ground such social commitments. And this potential is, in turn, realized only when a case can be made that a given event did indeed occur in a specific way in the past. In fact, sometimes this is the only way to argue for many present entitlements.

The acts through which we engage in and negotiate our social commitments are causal events: Their effect is the establishment of a "social fact." However, in contrast to causal events that result in changes in the physical environment, not only are many of the events establishing such social commitments (like promises) entirely transient, but also their effects are dependent on a social agreement, which in turn is dependent on what our conspecifics believe. The transient nature of these social events is

https://doi.org/10.1017/S0140525X17000012 Published online by Cambridge University Press

problematic both because, on the one hand, their committing force depends on their continuous influence through time and, on the other hand, by themselves they do not leave any physical traces of the events in question. If Susan promises Alan to meet him in front of the cinema at 8 p.m., she is obliged to be there, but this commitment survives (if at all) only in the mind of each party and perhaps of the witnesses of the interaction.

In principle, nothing but a reference to the specific occurrence establishing the commitment could be used to communicatively enforce the resultant obligations and entitlements. In fact, this is arguably one of the reasons for why humans have culturally developed so many "commitment devices": ways of making such arrangements either physically traceable in the form of written contracts and other kinds of symbols, or making the commitment public so that it becomes impossible to deny one's obligation without damaging one's reputation with everyone who co-witnessed the event in question. Short of, and often in spite of, such commitment devices, however, nothing but one's memory of the interaction will be able to advocate whether and how obligations and commitments are distributed. If Susan does not turn up in time in front of the cinema, invoking Alan's memory of the interaction with Susan will allow him to confront her not just by citing the obligation that she failed to meet but also by justifying his belief in the existence of this obligation by referring to the event that generated it. The ability to explicitly refer back to specific past events is therefore essential for the argumentative negotiation of present obligations and entitlements.

3.4.2. Bookkeeping or remembering? Social commitments have evolutionary significance because they make it possible for parties in an exchange to gain benefits that would be unattainable in the face of the risk of defection. Such commitments become important in the large spectrum of social relations in which the incentives of the involved parties are only partly aligned. As soon as incentives are entirely aligned or entirely misaligned, there is no room for such commitments to be effective because, in the former case, trust is not required, and in the latter case, trust is impossible. As Schelling (1960) pointed out, such a situation of partly misaligned incentives characterizes the large majority of our social interactions. Thus, social commitments dramatically expand the range of possible ways of cooperation.

In principle, to make social commitments effective, all that is cognitively required is a mechanism that keeps track of the distribution of who owes what to whom (Brosnan & de Waal 2002; Schino & Aureli 2009; 2010). Such a "bookkeeping mechanism" does not need to consider the reasons for these commitments themselves. Bookkeeping allows one to keep track of and appropriately handle one's own and others' commitments. It also allows one to regulate one's trust toward others based on their willingness to reciprocate. Bookkeeping does not, however, allow one to argue for – and by arguing to effectively enforce, negotiate, or establish – one's entitlements. One can engage in various behavioral strategies to collect what one is owed or to retaliate against defection. However, being able to justify and thereby convince others about entitlements could avoid costly, and potentially escalating, physical conflict. Thus, episodic memory, by enabling reference to the past events that established specific entitlements, could serve the negotiation of cooperative interactions in humans.

3.4.3. Episodic memory content explained. These considerations then might provide an example for why humans should have developed a mechanism regulating communicative interaction about *specific events* in the *past*:

1. Social commitments are often generated by *singular events* whose effects are solely dependent on the way these events can be referred back to by the parties involved or by their witnesses.
2. The effects of social commitments always take place *in the future,* and their negotiation therefore will necessarily require representing them as having occurred *in the past*.

4. Conclusions

We have provided an attempt to explain human, mature episodic memory in functional terms. We have distinguished episodic memory from event memory and analyzed it as playing a generative role in the justification of our beliefs about past events. In explaining the function of this capacity, we have followed a two-pronged approach.

First, we have provided an account of the metarepresentational structure of episodic memory in terms of its role in communicative interaction. According to this view, autonoesis allows us to determine when and how to assert epistemic authority in negotiating the past. In effect, episodic memory allows us to communicatively support our interpretations of the past. This view can make sense of a range of empirical evidence: most importantly, why episodic memory construction has the tendency to confirm what we believe about the past and why it is nonetheless commonly veridical.

One consequence of this analysis is that episodic memory should be taken to be human specific. Other accounts arguing for this conclusion have been criticized for being unfalsifiable because they do not offer behavioral markers that could differentiate between autonoetic and non-autonoetic forms of event memory. Our account identifies a clear function for autonoetic remembering (the negotiation of epistemic authority), which other animals, in the absence of a communication medium capable of conveying justifications, do not need to fulfill. Thus, from our perspective, it seems unlikely that other animals (and very young children) would have the capacity for entertaining autonoetic memories, simply because they do not need them.

Another consequence of our account is therefore that the capacity for episodic memory and the capacity to communicate about the past linguistically should be importantly connected both developmentally and constitutively. Although we have not made any specific claims about development, there is at least correlational evidence from developmental psychology suggesting that the capacities for episodic memory and communication about the past are connected (e.g., Nelson & Fivush 2004). Childhood amnesia is generally thought to end between the ages of 3 to 5 (Hayne & Jack 2011), the same time when children begin to be able to use source information productively (Drummey & Newcombe 2002; Gopnik & Graf 1988; Whitcombe & Robinson 2000; Wimmer et al. 1988) and

https://doi.org/10.1017/S0140525X17000012 Published online by Cambridge University Press

start to display epistemic vigilance (Clément et al. 2004; Mascaro & Sperber 2009). In fact, infants (Bauer & Leventon 2013) and young children (Burns et al. 2015; Király et al. [in preparation]; Mullally & Maguire 2014) can recall and make use of event information, suggesting the operation of constructive processes resulting in event memories. However, only after the age of 3 do they become able to use this information as source information in communication (Haigh & Robinson 2009). These correlations invite further investigations of the relationship between the development of episodic memory and communicative expertise.

More generally, the account offered here is merely a functional one and does not make precise predictions about the information processing mechanisms involved. The function we propose could be implemented by a range of different mechanisms. Nonetheless, our account predicts that the main achievements in episodic memory development occur as a consequence of the development of retrieval mechanisms. Encoding mechanisms are important for a much wider range of capacities, most of which are not, in fact, connected to our capacity to communicate about the past.

In the second part of our approach, we have argued that a metarepresentational format is necessary for the representation of at least one type of past events – events that ground social commitments. Both the ambiguity and the centrality of social commitments in human social life necessitate efficient means to negotiate them communicatively.

There has been intense interest in the study of human memory and the cultural uses of recollection in the social sciences (a "memory boom," Winter 2001). From our perspective, it is not surprising that remembering should be of central interest to social scientists. After all, if we are right, episodic memory in some sense enables the commitments and entitlements that make up the web of social relationships we are embedded in both as individuals and as members of social collectives. Indeed, the same kinds of justificatory practices that are used in the negotiation of interpersonal commitments emerge on the collective level in how past events and their commemoration are used in the political arena in the negotiation of collective commitments and entitlements (e.g., Olick & Levy 1997; Pool 2008; Weiss 1997). We take our account to contribute to the integration of these different perspectives on human memory and its uses. Recollection, far from being the intimately private affair we intuitively take it to be, has a fundamentally social dimension.

ACKNOWLEDGMENTS

For helpful comments and discussion on earlier versions of this article, we thank Pascal Boyer, Gábor Bródy, Ildikó Király, Hugo Mercier, Kourken Michaelian, Helena Miton, Christophe Heintz, Josef Perner, Csaba Pléh, Denis Tatone, Dan Sperber, and Thomas Suddendorf. This work was partially supported by an Advanced Investigator Grant (#249519, OSTREFCOM) by the European Research Council.

NOTES

1. Specifically, it is not always clear how the distinction between episodic memory and autobiographical memory is drawn. We take autobiographical memory to refer to knowledge about the self and take the fact that episodic amnesiacs do not always lose this kind of knowledge to speak in favor of distinguishing between these concepts (Klein & Gangi 2010; Klein et al. 1996; Picard et al. 2013). It is our understanding that autobiographical memory is a specific kind of memory content, which can be, but is not necessarily, represented in episodic memory.

2. Autonoesis is sometimes understood as a form of phenomenal consciousness. We take such a characterization to be unhelpful for a functional explanation as long as it does not offer an account of what information is specifically carried by this phenomenology. The characterization of autonoesis in terms of its phenomenology alone does not explain anything, but merely describes a feature of episodic memory, which should be an *explanandum* for any functional account.

3. Here, we adopt Perner's (1991; 2012) view of a metarepresentation as a "representation of a representation *as a representation*." This formulation is stronger than conceptualizations proposed by other authors who conceive of a metarepresentation as merely a "representation of a representation" (e.g., Sperber 2000). However, our characterization of episodic memory as metarepresentational in this strong sense does not entail that all metarepresentations must be of this kind.

4. Although we do not have the space to go into defending a specific view of memory traces here, we do not want to be understood as claiming that traces literally "encode" events. The trace itself is not an event representation but rather consists merely of information allowing the hippocampus to reconstruct a given event representation (a similar view is, for example, defended by De Brigard et al. 2013; De Brigard 2014b).

5. Note that our claim that the content of autonoesis refers to the source of a memory says nothing about the exact mechanisms producing this content. One possibility is that autonoesis is simply the product of source and reality monitoring processes (Johnson 2005). But other possibilities exist: Michaelian (2016a), for example, proposes that autonoesis is an outcome of a distinct, "process monitoring" mechanism. Here we merely commit to the claim that autonoesis proper is not an outcome of the event construction process itself, but depends on a second-order process.

6. Metarepresentations can be constructed from any representation, not just propositional ones. Thus, we chose the term *epistemic* attitude here to highlight that the metarepresentation involved in episodic memory can be viewed as analogous to a propositional attitude in that it governs the epistemic status of its content, but differs importantly in that it can apply to content that is itself not entirely propositional. Nonetheless, not all epistemic attitudes are metarepresentational (see next section).

7. The term *generative* is sometimes used to describe the view that episodic memory's contribution to the formation of knowledge is the production of new belief (content) due to its constructive character (Michaelian 2011a). This is then commonly contrasted with *preservative semantic memory*, which merely preserves beliefs formed in the past without adding to their content. This way of framing the distinction is certainly appropriate to describe the differences between event memory and semantic memory. As far as episodic memory is concerned, however, we want to be clear that we adopt the term *epistemic generativity* to illustrate that only episodic (but neither event nor semantic) memory produces present *justification* for beliefs on the basis of constructed content.

8. In contrast, perceptual beliefs, for example, are entirely transparent. The perceptual character of the belief itself only figures in any inferences drawn from such belief in exceptional circumstances (for example, realizing that one is subject to a perceptual illusion). Our claim here is that while we often rely on information about past events in a similarly transparent fashion, in episodic memory proper, the representational character of the memory itself plays a part in the inferences we draw from it (see Burge 1993).

https://doi.org/10.1017/S0140525X17000012 Published online by Cambridge University Press

9. Compare this to perceptual processes where it is a common trope to point out that high-level beliefs do not and should not have any influence on what we perceive (Firestone & Scholl 2016).

10. Event memory can be considered to be past-directed only in a minimal, non-conceptual sense (see Russell 2014).

11. Note that we thus take the primary relevant contrast to be the one to event memory and not to semantic memory. To be sure, there is much to be said about the function of event memory (e.g., Nagy & Orban 2016), but this will not be our focus here.

12. Michaelian (2016a) has offered a more extensive discussion of the issues addressed in this section than we can cover here. Here we simply point out what we perceive to be the most central of our disagreements with his account.

13. To be sure, we frequently rely on epistemic authority in argumentation. Nonetheless, the mechanisms (by which claims to authority and arguments we try to change others' minds) differ.

14. In fact, from our perspective, the term *source monitoring* is slightly misleading because what these mechanisms monitor is not the source of our memories but their believability. Although the outcome of this process might be the ascription of a source, it does not monitor sources.

15. This is not to say that there are no other reasons why *event memory* requires veridicality. Because we are not concerned with event memory here, however, we do not discuss this issue.

Open Peer Commentary

Retrieval is central to the distinctive function of episodic memory

doi:10.1017/S0140525X17001248, e2

Sara Aronowitz

Department of Philosophy, University of Michigan, Ann Arbor, MI 48109.
skaron@umich.edu http://www-personal.umich.edu/~skaron/

Abstract: Episodic retrieval is heavily and asymmetrically dependent on the temporal order of the remembered events. This effect, or rather the underlying structure which it reflects, is a distinctive feature missing from the account in the target article. This structure explains significant successes and failures of episodic retrieval, and it has clear consequences for the fitness of the organism extending beyond communication.

"I can't find my keys!"

"When did you last see them?"

When having trouble retrieving an episodic event, such as where I put my keys, a common strategy is to run through the preceding events in order. For example, once I remember going out to get the mail, I'm more likely to remember hanging up my coat, and so on. This strategy works only because of a feature of episodic memory, which I'll refer to as *temporally ordered retrieval*. That is, the memory traces underlying episodic recall are organized such that the likelihood of retrieving information about an event at time t is significantly higher if someone is cued to retrieve information about an event at time $t-1$. Effects of this phenomenon have been well documented at the behavioral level, the most obvious being the asymmetrical contiguity effect in free recall (Healey & Kahana 2014), and the underlying temporal structure of memory representations is the subject of several computational hypotheses (Buzsáki 2005; Gallistel & King 2009). Temporally ordered retrieval is a distinctive feature of episodic memory; semantic memory, by contrast, seems to be far more permissive about the types and directions of associations. For instance, although my semantic memories of the history of Turkey might be organized so that some temporally adjacent events are associated with one another, I might just as well have strong associations between stories about Anatolia, or facts related to the military.

Mahr & Csibra (M&C) provide a list of the distinctive features of episodic memory that form the basis for their argument that episodic memory serves a communicative function. These features delineate the general content of episodic memory and the manner in which the content is presented – but not how the content is retrieved or which contents are more likely to be retrieved. Although it would be unfair to expect the authors to discuss all of the distinctive features, I argue that the omission of temporally ordered retrieval, and of retrieval effects more generally, raises serious issues for their account.

I propose the following methodological principle for functional theories in an evolutionary context: If a distinctive feature of a system explains a significant number of the system's failures and successes, then this feature is likely relevant for understanding the function of the system. I'll now present a success of the episodic memory system that is best explained by appealing to temporally ordered retrieval. Then I'll discuss common memory failures that reflect problems with retrieval.

One way to get a handle on memory successes is to study memory experts. A technique of memory experts that has been documented as early as Roman times is the *method of loci* (MoL) (Cicero, 55 BCE/1948). This technique is used by mnemonists such as Shereshevsky in Luria's famous case study (Luria 1987), but is also effective as an intervention in normal and clinical contexts (Dalgleish et al. 2013; Gross et al. 2014). The therapeutic use of the MoL by Dalgleish et al. indicates that it is not only a neat party trick, but also an intervention that can increase fitness. In the MoL, a list or other kind of minimally structured set of items is learned by visualizing a well-known environment. Then the subject imagines herself walking through the environment and storing each item on the list in a different location. In short, the MoL takes semantic information and transposes it onto an episodic structure. Insofar as we are in a position to identify any memory successes, the MoL is an excellent candidate – and it relies on temporally ordered retrieval.

Now for failures. It's close to a consensus in research on all kinds of long-term memory that retrieval tends to be a functional bottleneck (Sweatt 2010). One way of seeing this intuitively is to think of all the times you couldn't remember some fact that later came to you easily. That you can be cued into remembering in a different context indicates that the memory trace was there the whole time. Your failure was not a failure to encode or a failure to store the encoded trace for long enough, but a failure to retrieve the stored information. A clinical example is the selective retrieval of traumatic episodic memories in posttraumatic stress disorder (PTSD). Patients with PTSD experience retrieval of memories related to the traumatic event in an uncontrolled fashion in contexts in which these memories are not useful or relevant. PTSD is manifestly unhealthy for the patient and, therefore, a memory failure in the fitness sense.

In summary, temporally ordered retrieval is a feature of the episodic memory system that is critical for some significant memory successes and is implicated in other memory failures. Combined with the aforementioned methodological principle, we can conclude that a satisfactory theory of the function of episodic memory should involve an explanation of how the distinctive features of episodic retrieval contribute to that function, including but not limited to temporal ordering.

Can M&C accommodate temporally ordered retrieval into their framework? To do so, they would need to argue that it serves a communicative function. I'd be very interested to see how this could be accomplished, but I'll end by noting a possible obstacle. The example of the MoL suggests that episodic temporal ordering works closely with semantic retrieval – recall that the MoL records semantic information using the episodic system. To explain this relationship between the two memory systems and their respective content, M&C might have to extend their account to semantic

https://doi.org/10.1017/S0140525X17000012 Published online by Cambridge University Press

memory function. In particular, I suspect that because the distinctively episodic mode of retrieval follows a standardized, inflexible rule for forming associations, it's more faithful than the mode used in semantic memory. In tasks where we're required to report unstructured information, especially in a fixed order, a faithful, standardized retrieval system is ideal. However, the more flexible semantic system for associations is more effective for other tasks. This suggests a function for the cooperation and division of labor between the two memory systems, which is unlikely to be only adaptive for communication.

An adaptive function of mental time travel: Motivating farsighted decisions

doi:10.1017/S0140525X1700125X, e3

Roland G. Benoit,[a] Ruud M. W. J. Berkers,[a] and Philipp C. Paulus[a,b]

[a]*Max Planck Research Group – Adaptive Memory, and* [b]*International Max Planck Research School on Neuroscience of Communication, Max Planck Institute for Human Cognitive and Brain Sciences, 04103 Leipzig, Germany.*

rbenoit@cbs.mpg.de

http://www.cbs.mpg.de/independent-research-groups/adaptive-memory

berkers@cbs.mpg.de paulus@cbs.mpg.de

Abstract: The episodic memory system allows us to experience the emotions of past, counterfactual, and prospective events. We outline how this phenomenological experience can convey motivational incentives for farsighted decisions. In this way, we challenge important arguments for Mahr & Csibra's (M&C's) conclusion that future-oriented mental time travel is unlikely to be a central function of episodic memory.

Mahr & Csibra (M&C) dismiss future-oriented mental time travel as a central function of episodic memory (sect. 2.1.). In this commentary, we seek to challenge two central arguments to their conclusion: (1) their argument that deficient episodic memory does not impair future-oriented decisions and (2) their argument that a functional account of episodic memory based on future-directed mental time travel struggles to explain why it is possible to veridically recall past events.

There has been tremendous interest in mental time travel over the past decade, with a growing number of studies examining our capacity to imagine hypothetical episodes that either may take place in the future or that – counterfactually – could have happened in the past (Schacter et al. 2015). These studies have revealed striking similarities between such episodic simulation and episodic memory. For example, as mentioned by M&C, the two capacities are supported by the same core network of brain regions (Addis et al. 2007; Benoit & Schacter 2015; Hassabis et al. 2007a; Szpunar et al. 2007), are similarly deficient in amnesic patients (Hassabis et al. 2007b; Klein et al. 2002b; Race et al. 2011, but see also Squire et al. 2010), and also seem to exhibit parallel life span developmental trajectories (Addis et al. 2008; Busby & Suddendorf 2005). These observations have been taken to suggest that episodic simulation is based on an episodic memory system that provides stored details and constructive processes to recombine such details into novel events (Schacter et al. 2007).

Central to our commentary is a common feature of episodic memory and episodic simulation that is grounded in their autonoetic format: The two capacities allow for the experience of "what it felt like" in past events, "what it could have felt like" in counterfactual events, and "what it would feel like" in prospective events. In the following, we describe how these mental experiences can facilitate farsighted decisions. We thereby seek to challenge the aforementioned two arguments.

First, as M&C rightly point out, despite their inability to imagine coherent future episodes, amnesic patients are not generally blind to the future (Craver et al. 2014b). A paradigmatic example for future-oriented decisions consists of situations in which we have to choose between a smaller reward that we can receive immediately and a larger reward that we would receive only at a later time. People often make myopic decisions for the smaller reward in such situations, because they tend to discount the value of delayed rewards as a function of the time they would have to wait. M&C cite important evidence that amnesic patients don't discount future rewards more strongly than healthy people, despite their deficiency in simulating future episodes (Kwan et al. 2012; see also Kwan et al. 2013). These data thus seem to indicate that mental time travel does not contribute to future-oriented decisions. However, although amnesic patients typically don't show exaggerated discounting, we suggest, as detailed in the following, that they lack a particular mechanism that can adaptively *attenuate* such impulsive tendencies.

A possible reason for temporal discounting is that we generally don't experience the anticipated emotional impact of a future reward when making a decision (e.g., Rick & Loewenstein 2008). However, by simulating the future moment of consuming the reward, we can mentally create this experience. This simulated experience, in turn, has been hypothesized to increase the valuation of the delayed reward and, consequently, to attenuate discounting (Benoit et al. 2011; Boyer 2008). A growing number of studies have provided support for this hypothesis (e.g., Benoit et al. 2011; Liu et al. 2013; O'Donnell et al. 2017; Palombo et al. 2015; Peters & Büchel 2010). Critically, there is evidence that patients with hippocampal damage or atrophy following Alzheimer's disease, who are impaired at imagining future events, do not show reduced discounting in situations nominally fostering episodic simulation (Lebreton et al. 2013; Palombo et al. 2015; but see Kwan et al. 2015, where participants may have benefited from semantic, rather than episodic, future simulation; for further discussion, see Schacter et al. 2017). Although episodic memory is not necessary for all future-oriented decisions, we thus argue that – due to its autonoetic format – it conveys prospective emotions that can render such decisions more farsighted, thereby supporting a fitness-relevant mechanism that maximizes future benefits.

Second, M&C argue that a future-directed account of episodic memory struggles to explain why memories can be veridically recalled. Specifically, they suggest that re-experiencing a past episode does not contribute to future planning beyond what can be provided by semantic memory. In their example, one can infer that there is going to be a long line at the swimming pool without re-experiencing the extended wait during one's last visit. By contrast, we suggest that the emotions elicited by episodically remembering a past event (D'Argembeau et al. 2003) can further serve to motivate future plans (e.g., avoiding the pool to prevent repeated boredom). Critically, this is only the case to the degree that our memories are veridical (e.g., if the line was indeed that long).

Moreover, memories of actual experiences can be contrasted with simulations of counterfactual events (e.g., "If instead we had taken a trip to the lake …"). These counterfactuals induce emotional responses, such as regret, that further intensify with repeated simulations (Stanley et al. 2017) and that have been shown to influence prospective choices (Camille et al. 2004). Counterfactual simulations of reliably remembered events can thus motivate future-oriented decisions, which we argue constitutes an adaptive role for the veridical recall of the past (see also Schacter et al. 2015).

To conclude, we propose that episodic simulation – due to its autonoetic format – allows for the experience of prospective and counterfactual emotions that convey motivational incentives for farsighted decisions. We don't assume that there is necessarily only one central function to episodic memory, nor do we challenge a possible contribution to human communication. However, we suggest that future-oriented mental time travel – with its outlined adaptive value – remains a candidate that should not readily be dismissed.

https://doi.org/10.1017/S0140525X17000012 Published online by Cambridge University Press

ACKNOWLEDGMENT
This work was supported by a Max Planck Research Group grant awarded to R.G.B.

The dynamics of episodic memory functions

doi:10.1017/S0140525X17001261, e4

Dorthe Berntsen
Center on Autobiographical Memory Research (CON AMORE), Department of Psychology, Aarhus University, 8000, Aarhus C, Denmark.
dorthe@psy.au.dk http://pure.au.dk/portal/da/persons/dorthe-berntsen(2a5c3e80-973a-4b35-883d-a7de4143885c)/cv.html?id=32505546

Abstract: There is no doubt that episodic memory serves communicative functions, but Mahr & Csibra (M&C) overlook that this is not the only function served by memories of past events. Autobiographical memory research has identified several other functions, including purely directive functions. The functionality of episodic memory is not stable across situations; it varies dynamically with the demands of the retrieval context.

Mahr & Csibra's (M&C's) basic idea that remembering serves the justification of beliefs and that this justification has communicative and social functions is not new, but was formulated by Bartlett almost 100 years ago. In his seminal book, Bartlett (1932) stated: "Remembering appears to be far more decisively an affair of construction rather than mere reproduction. … The construction that is effected is the sort of construction that would justify the observer's 'attitude'" (pp. 205–206). This seems very close to the tenet in the target article that the construction of a past event serves to justify a present belief. Bartlett also considered the social and communicative functions of such constructions at length. Unfortunately, Bartlett's (1932) theory is not considered in the target article. It is therefore hard to evaluate exactly what M&C add to this classic of psychology.

In addition, an entire field seems to be neglected. M&C operate with two conceptions of memories for past events: *episodic memory*, which is characterized by a specific set of features (to which I will return shortly), and *event memory*, which is all other types of memory for past events. This division appears to leave no room for autobiographical memory, usually defined as memory for personal past events (Conway & Pleydell-Pearce 2000; Rubin 1986; 1996). It is unclear whether autobiographical memory should be viewed as an instance of episodic memory or event memory or neither. The target article mentions autobiographical memory in an endnote, leaving its role completely unclarified.

The problem is not simply failing to specify a slot for autobiographical memory in the taxonomy. The key problem is that a number of insights from the field of autobiographical memory could have informed M&C's theory but were ignored. For example, several autobiographical memory researchers have studied the perceived functions of memories for past events. They have developed psychometric tests to determine types of functions that people perceive to be associated with those memories and examined individual differences in their frequencies (Bluck et al. 2005; Harris et al. 2014; Webster 1993). Using experimental manipulations, they have examined interactions between perceived memory functions and other memory characteristics, such as emotional valence (Rasmussen & Berntsen 2009; Walker et al. 2009) or retrieval processes (Rasmussen et al. 2015).

Contrary to M&C's position, this research leaves little empirical basis for claiming a unitary and privileged role for a communicative function. In the autobiographical memory literature, the communicative function is just one among several identified uses of event memories in daily life. For example, there is empirical evidence that people perceive their memories of past events to direct their current behavior (also in non-communicative contexts) as well as to support their identity and sense of self-continuity (Bluck et al. 2005; Pillemer 1998; 2003; Webster 1993). There is also evidence that memories of past events serve emotion-regulation functions and that the tendencies to entertain these functionalities differ across age groups (e.g., Harris et al. 2014; Webster 1994).

In essence, two crucial problems follow from neglecting many findings in the autobiographical memory literature. First, in the target article, M&C give themselves the task of developing a theory that can account for what they consider as three central characteristics of episodic memory: the "epistemic generativity, autonoetic character, and proneness to belief congruency" (sect. 3, para. 1). They claim that these features agree with the key role of the communicative function of the memories. Although this is likely true, the exact same characteristics are congruent with a number of other functions served by the memories, such as guiding and directing ongoing behavior. To use M&C's own example, a vivid recollection of having turned off the oven before leaving the house to go for a walk does not just serve a communicative function in relation to one's companion, but it also serves a directive function in relation to one's ongoing behavior and would also do so in a solitary context ("yes, it is OK to continue the walk, the oven is turned off").

Second, although episodic memories are likely to have the characteristics mentioned by M&C, they have other central characteristics that go unmentioned. It is therefore not clear whether these other characteristics would fit or challenge the theory by M&C. For example, it is well-established that distinctive events are better remembered (Hunt 2006), and that episodic memories are cue sensitive and often come to mind unbidden. Involuntary (unbidden) memories of past events are at least as frequent as voluntary memories (Rasmussen et al. 2015). They can be highly vivid, are more often about specific events, and come with more emotional impact than their voluntarily retrieved counterparts (Berntsen 2009). Such memories have a number of functions that are constrained by the ongoing situation and its demands (Pillemer 2003; Rasmussen et al. 2015). The existence of such involuntary episodic memories with a diversity of functions also has implications for the claims of human uniqueness. Even if M&C are right that nonhuman animals do not make use of episodic memory in a communicative fashion, there is empirical evidence that they spontaneously retrieve memories of concrete past episodes to solve a problem in an ongoing situation, even after long delays, if exposed to distinct situational cues (Lewis et al. 2017; Martin-Ordas et al. 2013). This and similar studies speak against the claim that episodic memory is a uniquely human ability.

Perhaps the greatest problem with M&C's theoretical position is that they assume a unitary function of episodic memory and thus overlook that the functionality of episodic memory is inherently dynamic; that is, the functions served by any given memory vary as a function of the demands of the retrieval situation. Thus, the very same memory may have communicative functions in one situation and purely instrumental (or directive) functions in another depending on the retrieval context. Without such dynamics, episodic memory would not be adaptive.

Episodic memory must be grounded in reality in order to be useful in communication

doi:10.1017/S0140525X17001273, e5

Hartmut Blank
Department of Psychology, University of Portsmouth, Portsmouth, PO1 2DY, United Kingdom.
hartmut.blank@port.ac.uk http://www.port.ac.uk/department-of-psychology/staff/dr-hartmut-blank.html

Abstract: The primary function of episodic memory is to provide reliable information about reality that is essential for surviving and navigating in an environment. The communicative function of episodic memory "sits on top of" this basic function but does not, in itself, explain it in its totality (but may explain particular aspects such as its sensitivity to source credibility).

https://doi.org/10.1017/S0140525X17000012 Published online by Cambridge University Press

Mahr and Csibra (M&C) propose that autonoesis (being aware that one remembers a past event) as a core feature of episodic memory developed in order to equip people with epistemic authority in communication (i.e., being able to use the fact that one remembers as a claim to veridicality). Although I emphatically agree that social context is important for understanding episodic memory (and M&C provide a convincing analysis of episodic memory *function* in communicative contexts), I do not think that this communicative context has *produced* the crucial features of episodic memory (autonoesis and epistemic generativity, in M&C's analysis).

My main argument is that autonoesis can only grant epistemic authority (in one's own eyes and those of other people) if it reliably signals veridicality. There would be no point of having autonoetic awareness, and of using it within a communicative context, if "I remember" didn't mean a thing (e.g., I might "remember" then that I met the Queen yesterday, or went cross-country skiing in Finland, when I was actually working in my office). That is, communication crucially relies on autonoesis as a cue for veridicality – but is it plausible to suggest that communication led to the development of this signal in the first place (as M&C seem to do)? In my view, autonoesis and episodic memory as a whole have fundamental benefits outside any communicative context, mainly in terms of surviving and navigating in the environment. For example, accurately remembering places where food has been found or predators have been sighted previously will help an organism to survive, and remembering where exactly one has parked the car will save time on the way home. Of course, these things may be communicated to other people as well, but that doesn't affect the benefits. Also, whereas some of these benefits might be attained on the basis of mere factual knowledge (i.e., without autonoesis), this would be mainly restricted to situations where the environment is predictable and therefore an episodic record is not needed. As soon as contingencies vary or are unknown, an episodic record of the environment including autonoesis ("I'm sure I came past this building") is helpful.

The idea that (correspondence to) reality is primary and communication secondary (as far as these terms make sense in a context where communication constitutes a large part of reality) is also reflected in a classical social psychological theory: Festinger's (1954) social comparison theory. Applied to memory, this theory would emphasize a relation between autonoesis/veridicality and the social/communicative context that complements the justification relation highlighted by M&C. Specifically, rather than using autonoesis to claim epistemic authority in a communicative context, this context (i.e., other people) would be consulted as a source of evidence about reality whenever epistemic vigilance does not provide strong enough evidence to trust one's own episodic recollection (i.e., under conditions of uncertainty; for a review, see Blank et al. 2017).

That is, communication can inform beliefs about past events as much as autonoetic remembering can, each under respective circumstances. I have developed this view more systematically elsewhere (Blank 2017). Essentially, and relating to the veridicality theme above, people need veridical beliefs about the past, and these depend on both the output of their individual memory systems and (perceived) reality constraints that can be inferred from general knowledge or communicated through other people. Note in this respect that the emphasis here is different from M&C. While I agree that there is a reciprocal relation between recollective experiences and beliefs about past events, I take the latter to be an integral part of remembering (i.e., arriving at – and often further communicating – a believed memory of a past event in a process of conversion; Blank 2009; Tulving 1983a), not a mere inference from it. In fact, even the autonoetic experience itself is subject to external influence, as cases of induced false memories clearly illustrate (e.g., repeated visualization leading to ultimately "remembering" a suggested event; Hyman et al. 1995). Simple world knowledge can also provide constraints (e.g., making a mental simulation of floating in outer space unlikely to be interpreted as a memory for most people), but, on the other hand, the existence of non-believed memories (Mazzoni et al. 2010) also demonstrates that autonoesis can occur independently from and sometimes in the face of external influence.

In any case, the foregoing illustrates that the reality monitoring involved in autonoesis is often an inferential process in which attributes of the recollective experience and external knowledge are combined (Johnson 1988; Johnson et al. 1993; Lindsay 2008), which leads me to my final point. Although communication may not have shaped episodic memory as much in terms of *reality* monitoring and autonoesis (i.e., in terms of basic attributions to past reality), it may have played a more decisive role in *source* monitoring, that is, in attributions to particular social sources of information (mostly people but also media, etc.). Inasmuch as we consider input from other people to inform our beliefs about the past, being able to reliably identify the sources of this information is crucial for epistemic vigilance, such that greater (delegated) epistemic authority can be claimed for memories of past events that are informed by the testimony of credible others. Given that such testimony will mostly be obtained through communication, it seems very plausible that this function will have contributed to the development of such source monitoring processes.

Episodic memory isn't essentially autonoetic

doi:10.1017/S0140525X17001285, e6

Peter Carruthers

Department of Philosophy, University of Maryland, College Park, MD 20742-7615.

pcarruth@umd.edu http://faculty.philosophy.umd.edu/pcarruthers/

Abstract: I argue that the function attributed to episodic memory by Mahr & Csibra (M&C) – that is, grounding one's claims to epistemic authority over past events – fails to support the essentially autonoetic character of such memories. I suggest, in contrast, that episodic event memories are sometimes purely first order, sometimes autonoetic, depending on relevance in the context.

Mahr & Csibra argue that the (alleged) self-referential and metacognitive ("autonoetic") nature of episodic memory is a distinctively human adaptation subserving communication and claims to epistemic authority. But this argument is puzzling. The most that this communicative function requires is a robust disposition to *describe* one's memories in metacognitive terms. Whenever one has a conscious episodic event memory, which comprises perspectival modality-specific representations of an event felt as occurring some distance in the past, it will generally be an easy matter to report that one *remembers* it, and trivial, too, to report that one *saw* or *heard* (or whatever modality is appropriate) the event in question. Thus, the experiential mode of one's original experience of the event can be read directly off the content of the event memory itself. And the fact that it is a memory (as opposed to past-directed imagining) can generally be determined swiftly from the context (such as the question one has just been asked about the event, which evokes the memory) and/or from the speed, specificity, and vividness with which the memory emerges in consciousness. There is simply no need for an episodic event memory to possess self-referential or metacognitive content intrinsically. These contents can readily be computed at the time of reporting.

https://doi.org/10.1017/S0140525X17000012 Published online by Cambridge University Press

It might be argued that routine classification of one's episodic event memory as (say) a memory of seeing the event (in such a way that one experiences oneself *as* remembering having seen it) is to be expected as another instance of "thinking for speaking" (Slobin 1996). Because one regularly needs to *report* on one's event memories in metacognitive terms in order to claim epistemic authority over the events in question, it makes sense that one should automatically conceptualize one's memories in such terms, in such a way that they appear in consciousness already with the right format for verbal report; or so it might be claimed. But other alleged instances of *thinking for speaking* have been thoroughly critiqued (Papafragou et al. 2002; 2008; Trueswell & Papafragou 2010). There is no reason to believe that the present case should be any different. How one needs to report an event seems not to influence how one conceptualizes it; so why should the need for metacognitive reports of episodic memory influence the contents of those memories themselves?

It might more plausibly be argued that episodic event memories are routinely conceptualized in metacognitive terms to facilitate metacognitive self-management. One needs to keep one's future episodic imagining, one's past episodic imagining, and one's counterfactual imagining distinct from one's episodic remembering. Different functional roles – differing patterns of inference and decision making – will be warranted in each case. Hence, it might be adaptive for the category membership of such states to be built into their content during the construction process. One would thus experience oneself *as* imagining the future, *as* imagining counterfactually, or *as* remembering the past. This would then be *thinking for thinking* (or thinking for cognitive self-management) rather than thinking for speaking.

Even this *thinking for thinking* idea seems unnecessary, however. Episodic event memories will have a sense of pastness built into their content anyway (thus clearly distinguishing them from future imagining). And in most cases, the context in which the remembering occurs and such factors as immediacy, specificity, and vividness can themselves be the cues that trigger the appropriate forms of reasoning and decision making. We know that metamemory judgments depend on such cues (Mitchell & Johnson 2000). So it is unclear why it must be the metacognitive judgment rather than the cues themselves that determine the state's functional role.

It seems that neither thinking for speaking nor thinking for thinking provides a good reason for believing that human episodic event memories should have an essentially autonoetic, self-referential character. As a result, there is no reason to think that when memories with such a character do occur, they constitute a special, distinct kind of memory; nor is there any reason to think that there is a difference of *kind* between the episodic memories of humans and those experienced by nonhuman animals. In both cases, episodic event memories will be apt to emerge in consciousness fully formed, involving feelings of (some degree of) pastness, together with modality-specific perspectival representations of the events in question. Sometimes among humans such memories might be classified and experienced in the moment *as* memories; but on other occasions, one might experience just the first-order contents in question. This will depend on contextual factors, relevance, and the needs of the moment, just as whether one experiences a plant *as a bush* or *as an azalea* can vary with context and relevance. The level up to which an episodic memory is conceptualized (having just first-order, or rather first-order-plus-metacognitive, content) is unlikely to be any more fixed than is the conceptualization of experience quite generally. And for what it is worth (not much; see Carruthers 2011; Schwitzgebel 2011), I can report from my own case that my conscious episodic event memories are generally purely first order in nature. When I remember, I experience a set of perspectival modality-specific images of an event felt as occurring some distance in the past. But *that I am remembering* is infrequently a component of the experience itself.

Episodic memory is as much about communicating as it is about relating to others

doi:10.1017/S0140525X17001297, e7

Alin Coman

Department of Psychology & Woodrow Wilson School for Public and International Affairs, Princeton University, Princeton, NJ 08544.
acoman@princeton.edu
https://www.princeton.edu/~acoman/Home.html

Abstract: Mahr & Csibra (M&C) provide extensive evidence for the communicative function of episodic memory, suggesting that the malleability of human memory is in large part due to its communicative dimension. I argue that emphasizing the relational motivations involved in communication provides a more proximal explanation for why our memories are as malleable.

That memory is malleable is a well-researched and widely endorsed view in psychology (Schacter 2001). A key issue emerges from Mahr & Csibra's (M&C's) conceptualization: Why would a memory system be designed in such a way? What are the "forces" that could have led to such malleability? These "forces," M&C contend, have mainly to do with the intrinsic communicative function of memory. Because memories are used to argue about a particular version of an experienced past, episodic memory should be subjected to fallacies that typically apply to argumentation: confirmation bias, updating, and selectivity.

This claim has solid grounding in the extensive literature on social influences on memory. However, the approach proposed by M&C does not go far enough, I argue, in exploring the communicative function of episodic memory. This is because it focuses almost exclusively on the individual expressing the memory in a communicative setting. According to this view, the cognitive operations involved in these communicative acts are isolated to the individual's mind, with little consideration for the social space in which communication takes place. Understanding the listener's experience during the communicative event, I contend, highlights the role of an unexplored facet of communication – its relational motivation – in shaping memory. I want to argue that our memories are as adaptable as they are – not necessarily because they involve a communicative dimension, but because communication involves relating to another individual. In other words, adaptive memory systems, able to integrate social influences, will allow for the creation of shared memories among the communicators. This, in turn, facilitates joint behavior and coordinated action and, due to these benefits, might offer adaptive advantages to the individual.

Evidence for the role that relational motivations play in shaping memory comes from the processes involved in the selective retrieval of previously encoded memories. Several studies have shown that listening to another person retrieving previously encoded information leads to the strengthening of the retrieved information, but at the same time, it results in the induced forgetting of related, unretrieved information (Cuc et al. 2007). Importantly, these effects occur only when the listener is concurrently retrieving the information along with the speaker. But not all listening experiences result in the concurrent, and covert, retrieval of information along with the speaker. On the one hand, concurrent retrieval is influenced by the listeners' motivations to be accurate about the past (i.e., epistemic motivations), as shown by Cuc et al. (2007) and Koppel et al. (2014). These motivations were front and center in M&C's approach and for good reason. More importantly for the claims made herein, the motivation to relate to the speaker (i.e., relational motivation) impacts the degree to which listeners experience retrieval-induced forgetting following the listening task. When participants (Princeton students) listened to another Princeton student selectively practicing previously encoded information, they were more likely to forget information that was related to what the speaker mentioned than when they listened to a Yale student (Coman & Hirst 2015). Thus, the

https://doi.org/10.1017/S0140525X17000012 Published online by Cambridge University Press

listeners' motivation to relate to an in-group member impacted the degree to which they concurrently retrieved the information with their fellow in-group member.

These phenomena have consequences for both conversational partners. If the speaker and the listener strengthen similar memories and they both experience suppression of the undiscussed related information, then their memories will become more aligned following collaborative remembering, as found by Stone et al. (2010) and Coman and Hirst (2012). And having similar memories could impact people's sense of shared identity (Fivush 2010a), their ability to make collective decisions (Kameda et al. 1997), and their collective behavior (Harris 2006). So adaptive memory systems constitute the building blocks of social formations (Coman 2015). This view goes beyond simply acknowledging *that* we communicate our memories and emphasizes the *why* of communication, which might constitute a more proximal explanation for the malleability of human memory.

Expanding the communicative dimension that characterizes our episodic memories from its epistemic function to its relational function will result in a more complex view of human memory. The reason why we have the flexible memory systems that we do is because this allows communicating individuals to create a shared reality or worldview (Hardin & Higgins 1996). Through its impact on group identity and collective coordination, the ability to create a shared reality with others might have provided selective advantages in the evolution of the human species.

Why episodic memory may not be for communication

doi:10.1017/S0140525X17001303, e8

Felipe De Brigard[a–d] and Bryce Gessell[a]

[a]*Department of Philosophy, Duke University, Durham, NC 27708;* [b]*Department of Psychology and Neuroscience, Duke University, Durham, NC 27708;* [c]*Center for Cognitive Neuroscience, Duke University, Durham, NC 27708;* [d]*Duke Institute for Brain Sciences, Duke University, Durham, NC 27708.*

felipe.debrigard@duke.edu www.imclab.org
bryce.gessell@duke.edu www.emps.me/bryce

Abstract: Three serious challenges to Mahr & Csibra's (M&C's) proposal are presented. First, we argue that the epistemic attitude that they claim is unique to remembering also applies to some forms of imaginative simulations that aren't memories. Second, we argue that their account cannot accommodate critical neuropsychological evidence. Finally, we argue that their proposal looks unconvincing when compared to more parsimonious evolutionary accounts.

Mahr & Csibra's (M&C's) article is full of thought-provoking ideas but also contains serious conceptual and empirical difficulties. Here we articulate three challenges that may severely undercut M&C's claim that remembering is for reason-giving communication. The first challenge is conceptual. According to M&C, episodic memory consists of an epistemic attitude to the effect that the content of the mental simulation provides us with information that has been obtained firsthand. However, there are certain kinds of mental simulations that provide us with firsthand information and yet wouldn't qualify as episodic memories. Consider the following case. You are snowboarding down a steep hill and nearly avoid a pine tree you somehow failed to notice. An immediate, involuntary counterfactual simulation comes to mind: "Had I been a meter to my right," you think, "I would have been dead now." This automatic "subjunctive replay," as Hofstadter (1982) playfully calls it, provides us with firsthand information as to what would have happened had a minor deviation from reality occurred instead of what actually was the case.

Indeed, some philosophers have argued that these kinds of imaginative simulations constitute knowledge (e.g., Williamson 2007; 2016). Nevertheless, you wouldn't say that you remember hitting the tree a minute ago: You just imagined it could have happened. Therefore, it looks as though there is a species of episodic counterfactual simulation (De Brigard 2014a; De Brigard & Giovanello 2012; De Brigard et al. 2013) that is quasi-experiential, event specific, epistemically generative, autonoetic, and past-directed that nonetheless is not a memory. Perhaps M&C could defend their account by arguing that because these kinds of episodic counterfactual simulations do not represent actual past events but rather closely possible past events, they fail to meet the past-directedness requirement of episodic memories. But this response won't do, for the same occurs with many of our ordinary reconstructed memories, as they normally represent past events with some degree of deviation from what actually happened in the past. An account of episodic memory that cannot include these normally distorted reconstructed memories would fail to capture the psychological reality of remembering.

Their proposal also faces serious empirical challenges. First, if episodic memory is for a particular kind of reason-giving communicative interaction, as M&C claim, then we should expect to see individuals with episodic memory deficits – for instance, patients with amnesia due to medial temporal lobe damage or individuals with severe depression – exhibiting difficulties when carrying out such communicative interactions. Unfortunately, not only do M&C fail to provide neuropsychological support for this observation, but also there seems to be enough evidence against its being the case. For example, patient HM, a notoriously famous case of episodic autobiographical amnesia, did not seem to have trouble engaging in all sorts of reason-giving communications about past events, as long as these events were in the recent past and HM was able to entertain them in working memory (see Corkin 2013 for plenty of examples of these sorts of reason-giving communicative exchanges between HM and others).

Of course, HM had trouble generating reasons whose contents depended on his capacity to bring back to mind *remote* past events. But this just shows that episodic memory is *necessary* for generating some contents – that is, contents about remote first-person past experiences – that may feature in reason-giving communicative exchanges about the past; in no way does it show that such is its function. HM's machinery to engage in the communicative reason-giving transactions, which M&C claim that remembering is for, was, in fact, intact. What HM lacked was the capacity to generate the contents that would feature in a subset of such reasons, namely, those about remote past experiences. Failing to generate mental contents that can feature in reason-giving communicative interactions is, at best, very weak evidence for saying that the psychological process that produces such contents evolved for the purpose of reason-giving communication. Consider an analogy: cortically blind people cannot generate visual contents that could feature in reason-giving exchanges about objects in their visual field. Should we take this as evidence for the claim that vision evolved so we can engage in reason-giving exchanges with conspecifics about objects in our visual field? This claim seems preposterous, even for evolutionary psychology.

The final challenge we put forth is somewhat related. It is reasonable to suppose that, with the development of language and complex social interactions, humanity faced a new fitness problem: how to keep track of others' assertions and testimonies. Because such assertions and testimonies often involved past events, it seems reasonable that humans developed strategies to temporally keep track of the veracity and reliability of people's assertions and testimonies. From the pressure to exercise this sort of "epistemic vigilance" onto others – M&C argue – arose episodic memory. But why should this particular kind of tracking be that for which episodic memory evolved? After all, our ancestors presumably had to temporally track all sorts of different items that were critical for survival: predators, poisonous plants, dangerous areas, glucose rich fruits, and so on. Wouldn't it be more reasonable to say that episodic memory evolved to help us keep track of such fitness-enhancing items, and that once there, our ancestors

https://doi.org/10.1017/S0140525X17000012 Published online by Cambridge University Press

were able to capitalize on an already available system for temporal tracking of past events and redeploy it to track, among other things, assertions and testimonies? It seems very unlikely that the fitness-enhancing item episodic memory evolved for was something as culturally dependent and as phylogenetically recent as reason-giving assertions and testimonies. It seems much more parsimonious to think that this kind of tracking came about because we already had the kind of episodic memory that allows us to track fitness-enhancing stuff in general, of which conspecifics' reliable testimonies are just one part.

Remembered events are unexpected

doi:10.1017/S0140525X17001315, e9

Jean-Louis Dessalles

LTCI, Telecom ParisTech, Universite Paris-Saclay, F-75013 Paris, France.
dessalles@telecom-paristech.fr **www.dessalles.fr**

Abstract: We remember a small proportion of our experiences as events. Are these events selected because they are useful and can be proven true, or rather because they are unexpected?

Remembered events are universally and massively recounted during spontaneous human conversation. Despite early studies (e.g., Tannen 1984), the importance of the phenomenon has long been ignored: It occurs only among people who are already acquainted, and it is absent from most corpora recorded in the lab (Norrick 2000). According to some figures, telling past events may represent up to 40% of conversational time (Eggins & Slade 1997, p. 265). Measures I made through a sampling method on a corpus of family conversation (about 18 hours recorded during 3 years) resulted in the following estimates: 27% of conversational topics consisted in narratives about past events, while another 12% were about current events (Dessalles 2017). Although these proportions are expected to vary significantly depending on the corpus, they indicate that talking about events constitutes one of the main human activities. Is the prevalence of this form of communication consistent with Mahr & Csibra's (M&C's) claims about the role of episodic memory?

If the main function of episodic memory is communication, as M&C propose and as I myself submitted (Dessalles 2007a), episodes get stored in memory just to be used during future conversations. This comes with a significant cost, if we consider that the large size of the brain sustained by humans is in part due to the need of making detailed retrieval of events possible (Suddendorf & Corballis 2007). The benefit must be substantial to match this cost. What does this benefit consist of?

According to M&C, communicating about events gives senders an opportunity to induce "in their audience a representation of the past that is to their benefit" (sect. 3.2.3, para. 1). My study of spontaneous conversations does not support this schema. I have been unable to detect clear self-promotion in the narratives of my corpus or in other corpora. On many occasions, the converse can be observed (Rimé 2005). People do not hesitate to tell events in which they performed inappropriate actions. In Norrick's corpus, for instance, a narrator explains that she was hired at a Burger King restaurant for her first job. She was trained during one week, and then, as she was about to take her very first order from a customer, she said into the microphone "Welcome to McDonald's!" (Norrick 2000, pp. 30–31).

Another advantage of storing events, in M&C's view, is that past events can be used as justification during debates and are themselves designed to resist epistemic attacks. Indeed, narratives may be used as arguments during discussions, and conversely, inconsistencies may be pointed out when a narrative is told. But these phenomena remain marginal. In the aforementioned analysis (Dessalles 2017), only 16% of the narratives have a logical connection with the previous topic, and only 5% of the discussions are triggered by a narrative. Most narratives are connected to a preceding narrative topic through close analogy (42%) or through mere association (26%). The mention of a past event tends to prompt another, related narrative. This phenomenon has been named *story rounds* (Tannen 1984, p. 100). Narratives have their own dynamics, distinct from debating. If past events surface so often in human conversation, it must be for some reason other than their epistemic value.

If remembered events were selected for their epistemic robustness, we would prefer events for which evidence is available and can be produced on demand. "I flew from Boston to Paris on June 13, 2006" is such an event. But this episode together with the associated details is unlikely to be worth remembering or worth telling in most contexts, regardless of its epistemic solidity. In earlier work (Dessalles 2007a), I suggested that *events that are memorable are exactly those that are narratable*. And we know what makes an event narratable: It has to be *unexpected*, that is, it has to be causally complex but conceptually simple (complexity and simplicity here refer to minimal description length – see www.simplicitytheory.science). In the Burger King story, the mention of the competitor is both conceptually simple (it is the best-known competitor) and causally complex (it was the last thing to say). The Boston–Paris example would have been more unexpected with a simpler date: "I flew from Boston to Paris on September 11, 2001" but less unexpected if the action was less complex to produce: "I had breakfast on September 11, 2001." One can play with these two qualities – causal complexity and conceptual simplicity – to predict what will be remembered; their combined effect makes some events unforgettable for an entire life.

If events are remembered and told based on their unexpectedness, does it match the audience's interest? According to M&C, "receivers are interested in acquiring useful (i.e., true) information" (sect. 3.2.3, para. 1). Narratives are, however, ill-designed to convey useful knowledge. Memorized events are selected to be unexpected, not to be consequential. Most conversational narratives are indeed about futile matters, such as oddities or coincidences. In the case of fiction, the audience accepts giving up truthfulness and even likelihood just to enjoy being surprised by unexpected events. Nevertheless, we may wonder why, as M&C observe, it is still important for a reported past event to be regarded as true. Is it because the audience wants to draw general lessons from it? There is a better explanation. Unexpectedness depends on causal complexity, and causal complexity crucially depends on the story being true. If I am lying about my Boston–Paris flight on 9/11, the false event loses its causal complexity (because it did not really happen) and turns out to be devoid of interest.

Episodic memory is geared to supply human beings with unexpected events worth telling. In our species, producing unexpectedness is crucial for having a chance of attracting friends (Dessalles 2014). The question of reliability is subordinate to the criterion of unexpectedness. We select a tiny proportion of our experiences and we remember them, not because they are true, but because they are unexpected.

Sleep to be social: The critical role of sleep and memory for social interaction

doi:10.1017/S0140525X17001327, e10

Susanne Diekelmann,[a,1] Frieder M. Paulus,[b] and Sören Krach[b,1]

[a]*Institute of Medical Psychology and Behavioral Neurobiology, University Tübingen, 72076 Tübingen, Germany;* [b]*Department of Psychiatry and Psychotherapy, Social Neuroscience Lab | SNL, Lübeck University, Center of Brain, Behavior and Metabolism (CBBM), 23538 Lübeck, Germany.*
susanne.diekelmann@uni-tuebingen.de
http://www.medizin.uni-tuebingen.de/en/Research/Institutes/Medical+Psychology/Staff/Diekelmann_+Susanne_+Dr_+port-80-p-68596.html

https://doi.org/10.1017/S0140525X17000012 Published online by Cambridge University Press

paulus@snl.uni-luebeck.de
https://www.snl.uni-luebeck.de/staff/ag-paulus-social-neuroscience-methods/scientific-staff/frieder-paulus.html
krach@snl.uni-luebeck.de
https://www.snl.uni-luebeck.de/staff/ag-krach-social-neuroscience-in-psychiatry/scientific-staff/soeren-krach.html

Abstract: Humans are highly social animals who critically need to remember information from social episodes in order to successfully navigate future social interactions. We propose that such episodic memories about social encounters are processed during sleep, following the learning experience, with sleep abstracting and consolidating social gist knowledge (e.g., beliefs, first impressions, or stereotypes) about others that supports relationships and interpersonal communication.

In their target article, Mahr & Csibra (M&C) propose a compelling and intriguing account of episodic memory as an essential part of human social interaction and communication. They suggest that episodic memory is tailored to provide reasons for people's beliefs and interpretations of the past in the communication with others. We propose that sleep may play an important role in this social dimension of episodic memory.

Sleep is well known to support the consolidation of episodic memory (Diekelmann & Born 2010). Episodic experiences are retained more successfully in memory if the experiences are followed by a period of sleep compared to an equivalent period of wakefulness (Rasch & Born 2013). In line with the active system consolidation account, sleep initially strengthens and stabilizes episodic experiences in the autobiographical context with rich spatiotemporal information (Inostroza et al. 2013). Over subsequent sleep periods, possibly spanning several days or weeks, sleep then transforms these detailed episodic memories into more schema-like representations for the long term (Lewis & Durrant 2011). Sleep thereby abstracts and generalizes single episodic memories, leading to the generation of new gist knowledge (Lutz et al. 2017) and, in some cases, even to the development of false memories (Diekelmann et al. 2010; Payne et al. 2009). In this consolidation and transformation process, sleep particularly facilitates memories that are important to the individual and relevant for future behavior. Thus, sleep preferentially supports memories that are emotionally salient (Payne & Kensinger 2010), that are expected to be tested after sleep (Wilhelm et al. 2011), that are expected to be rewarded (Fischer & Born 2009), and that are associated with a plan to be executed in the future (Diekelmann et al. 2013).

These essential functions of sleep for episodic memory may build the foundation for successful social interaction and communication with others during the day. Based on the notion that humans constantly represent themselves in the context of their surrounding social world (Müller-Pinzler et al. 2017), we propose that episodic memories about others (and possibly also about ourselves during those episodes with others) are processed and abstracted during sleep. The vast information about the encounters with others initially is stored in the form of single episodic memories (e.g., one person telling the truth in situation A, while another person behaves awkwardly in situation B). These single episodic memories are presumably also laden with an emotional tone that was experienced during the social interaction, ranging from basic emotions such as joy or fear to specific interpersonal emotions such as embarrassment or pride (Müller-Pinzler et al. 2015; 2016; Paulus et al. 2015). We propose that sleep strengthens and consolidates these single and emotionally laden encounters and idiosyncrasies in episodic memory.

Yet, in the long run it may not be efficient to remember every single encounter and every single detail in episodic memory (e.g., where it was, when it was, what happened). What is important is to remember the essential gist of the single encounters, which can then be stored in the form of new gist knowledge for the long term. Sleep may help abstract this gist from single social interactions, essentially building more general beliefs about others (e.g., this person is trustworthy). Social information about other people is particularly relevant in humans, considering that humans are highly social animals and social information about others can be critical for future situations. For example, remembering from current encounters whether another person is trustworthy is highly important for future social interactions when an individual has to decide whether or not to trust that person. In the worst case, this knowledge can decide about life or death. This critical importance of social information may also be signaled by the emotional salience of social encounters. By favoring such relevant and emotionally salient information, sleep may preferentially boost the consolidation and abstraction of social episodic memories over non-social memories to ensure the individual's social fitness.

In this way, sleep-dependent episodic memory consolidation may help decide what to believe about others and how to behave in future social interactions. Social episodic memories, having been processed, abstracted, and shaped during sleep, may give reasons to support social relationships and interpersonal communication. This social function may indeed be one of the most important functions of episodic memory consolidation during sleep in humans. Disruptions of normal sleep patterns may hamper the processing and abstraction of social gist information, potentially leading to impairments in social interaction and communication, such as in autism spectrum disorders (Devnani & Hegde 2015). Understanding the relationship between episodic memory, sleep, and social functioning will be an intriguing and promising target for future research.

NOTE

1. Corresponding authors.

Emotional memories and how your life may depend upon them

doi:10.1017/S0140525X17001546, e11

Tayler Eaton and Adam K. Anderson

Affect and Cognition Laboratory, Department of Human Development, Cornell University, Ithaca, NY 14850.

te82@cornell.edu http://aclab.human.cornell.edu/people/tayler/
aka47@cornell.edu http://aclab.human.cornell.edu/people/adam/

Abstract: In this commentary, we discuss how one's internal body state and the appraisals an individual utilizes at encoding alter later episodic memory irrespective of social discourse. We suggest that the purpose of episodic memory is originally the preservation of the self, which may have been co-opted to navigating the social world.

Mahr & Csibra's (M&C's) proposed communicative function of episodic memory as a tool for discourse and for memory accuracy detection in others is a novel contribution to our understanding of the function of episodic memory. However, the original function of episodic memory is to enhance personal survival, only part of which can be understood with regard to interpersonal function. Although humans are inherently social, and the ability to gain trust and interpret the trustworthiness of others is certainly important to our survival, we suggest that the emotional modulation on the episodic memory system, specifically related to appraising the significance of events to the self, developed to navigate first the physical and then the social world.

Episodic memory changes as a function of self-centered appraisals, which derive from personal significance and drive emotional experience. M&C suggest that our ability to encode rich, detailed descriptions of an event function as a way to provide evidence to others of the veridical nature of our memories. However, the vividness of events varies according to the way in which the memory was individually and idiosyncratically encoded. This is in part related to variation in genes' altering neurotransmitters regulating bodily sympathetic (e.g., blood pressure and heart rate) and neural stress-arousal systems. We have shown that the ADRA2b polymorphism regulates the experience of arousal

https://doi.org/10.1017/S0140525X17000012 Published online by Cambridge University Press

during encoding, determining first what is likely to be attended and perceived and only then later remembered (Todd et al. 2013; 2015).

The expression of these genetic arousal modulatory influences on episodic memory also interact with specific emotional appraisals and defensive and appetitive reactions. Emotional arousal increases vividness of recollection; specifically, negative emotional arousal is associated with greater detail in recognition memory, and positive emotional arousal at encoding results in greater recollective memory (Gomes et al. 2013). Yet when arousal is controlled, negatively valenced stimuli increases gist memory (Bookbinder & Brainerd 2017) – episodic memory, therefore, is altered later on as a function of an individual's internal state and interpretation of stimuli at the moment of encoding. Within negatively valenced responses, disgust appears to have a stronger grip on attention and memory than anxiety (Chapman et al. 2013). The specific and varied influence of emotional states and appraisals at encoding clearly change the nature and strength of memory. Each of us wear genetic and emotional experiential lenses that filter experience in unique ways to modulate the character of episodic memory. Whereas some of us may remember for the sake of benefits to others, many of us remember to save our bodies and ourselves.

Encoding of events in relation to the self, and specifically in relation to survival, even without elevated emotional arousal, has potent influences on episodic memory. Irrespective of emotional state, the appraisals an individual utilizes, whether related to meaning or self-relevance, alters the magnitude and quality of their recall. These may originate from life-or-death appraisals. Indeed, the central tenet of *adaptive memory* is that our memory systems evolved with a preference for fitness-related information, demonstrating that episodic events related to our survival are associated with greater recall than other episodic events (Nairne et al. 2007). The prevalence of false memories varies in a similar way. Negative emotional memories, as well as neutral events processed in relation to one's survival (Otgaar & Smeets 2010), are associated with higher vividness and higher rates of false memory (Brainerd et al. 2008). False memory does not occur only in situations where one is to serve as witness or is engaged in discourse to aid in collective memory, as would be expected by M&C's characterization of episodic memory.

ADRA2b polymorphisms regulating brain norepinephrine extends beyond individual differences in emotional arousal and healthy memory to the formation of traumatic memories and posttraumatic stress disorder (Todd et al. 2014). Biological predispositions in conjunction with traumatic experience can alter how one sees, appraises, and remembers the world. People who have experienced traumatic events differ in their views of self and world based on how they appraised the event at encoding (Sutherland & Bryant 2008). Internal appraisals of situations alter an individual's beliefs about past events and self-concept in lasting ways that hold true over time (Startup et al. 2007). Critically, these shifts in viewpoint are also often associated with a *reduction* in interpersonal interaction and discourse (e.g., McFarlane & Bookless 2001). The nature of intrusive memories following trauma is inherently personal; in its vivid re-experiencing, it is common for people with posttraumatic stress disorder to be uncomfortable discussing these experiences with others (e.g., Cook et al. 2004). Vivid recollection in trauma is associated with sharing less, not more, limiting what is transmitted collectively.

Although highly emotional and traumatic experiences may reflect a broken episodic memory system, they might also serve to illuminate the origins of episodic memory. What we have learned from the neurogenetics of emotions and traumatic memory is that episodic memory likely originates first in preserving the integrity of one's physical body, and that has expanded to include the mental self. Only thereafter may it have been co-opted broadly for the purposes of preserving the fabric of the collective social self.

The communicative function of destination memory

doi:10.1017/S0140525X17001339, e12

Mohamad El Haj[a,b] and Ralph Miller[c]

[a]*SCALab – Sciences Cognitives et Sciences Affectives, Université Lille, F-59000 Lille, France;* [b]*Unité de Gériatrie, Centre Hospitalier de Tourcoing, 59200 Tourcoing, France;* [c]*Department of Psychology, State University of New York, Binghamton, NY 13902-6000.*

mohamad.elhaj@univ-lille3.fr

https://www.researchgate.net/profile/Mohamad_El_Haj2

rmiller@binghamton.edu

https://www.binghamton.edu/psychology/people/rmiller.html

Abstract: Mahr & Csibra's (M&C's) proposal that episodic memory has a role in communicative interaction is innovative. However, the model would be strengthened by the inclusion of the construct of destination memory. Destination memory refers to the ability to remember to whom one has sent information. Research has demonstrated that this ability is essential for communicative efficacy and daily interactions with others.

We applaud Mahr & Csibra (M&C) for taking an innovative and comprehensive look at the communicative function of episodic memory. However, to understand the communicative function of memory, it may be especially useful to draw upon insights from research on destination memory, especially research that explores the relationship between destination memory and social communication.

Destination memory refers to the ability to remember to whom one has sent information (e.g., "Did I tell John or Mary about the conference?" "Did I send that email to John or Mary?") (Brown et al. 2006; El Haj & Miller 2017; Gopie et al. 2010; Gopie & Macleod 2009; Hornstein & Mulligan 2004; Koriat et al. 1991; Koriat et al. 1988). Destination memory can be considered as a facet of episodic memory because destination memory allows fuller reconstruction of the context in which an episodic event has occurred (El Haj et al. 2014). Unlike other components of the episodic system (e.g., memory of the where and when), destination memory centrally involves social communication. In our daily lives, we constantly relay information to family members, colleagues, friends, and/or strangers. A typical illustration of costs that may result from distortions in destination memory is expecting a report from a colleague when we initially asked another colleague to prepare it. Another consequence of destination memory distortions on social communication is redundancy, that is, the tendency to repeat the same information to the same receiver, a behavior that is often observed in amnesia (El Haj et al. 2016; 2017a). These examples illustrate how important destination memory can be for communication.

Communication is a core concept of the target article. M&C propose an original account that views episodic memory as a mechanism supporting human communication. At the heart of their account, episodic memory serves people in asserting epistemic authority about the past. In our view, this asserting of authority can be enhanced by attributing information to its appropriate destination. For example, *I am sure* (asserting epistemic authority) *that John was present during the meeting as I remember asking him* (destination memory) *to bring the report*. More specifically, M&C suggest that, in order to assume this epistemic authority, humans have evolved a suite of social capacities that allow them to scrutinize their interlocutors. In our view, these abilities can be better understood by highlighting how destination memory can be related with our ability to scrutinize affective and cognitive states of interlocutors. Specifically, destination memory can be influenced by our ability to assess affective and cognitive states of interlocutors. In line with this suggestion, research has demonstrated how destination memory can be influenced by our familiarity with interlocutors, stereotypes that are associated with them, and their emotional states, as well as by our ability to infer and predict what they know (i.e., theory of mind). Also,

https://doi.org/10.1017/S0140525X17000012 Published online by Cambridge University Press

studies have found that destination memory can be influenced by deception.

To begin with familiarity, research demonstrates higher destination memory for familiar than for unfamiliar interlocutors (El Haj et al. 2015c). Turning to stereotypes, experiments have found better destination memory for stereotype-consistent facts (e.g., facts concerning mechanics that were previously told to a mechanic) than for stereotype-inconsistent facts (e.g., facts concerning mechanics that were previously told to a physician) (El Haj 2017). As for emotion, studies have observed superior memory for facts told to negative (e.g., sad) than to positive (e.g., happy) faces and more robust memory for facts told to positive rather than to neutral faces in healthy older adults (El Haj et al. 2015a; 2015d). These findings suggest that emotion plays an important role in destination memory in normal, elderly adults. As for theory of mind, this ability can be related to destination memory because both abilities require processing attributes of interlocutors during social communication (El Haj et al. 2015b; 2016). As for deception, research demonstrates better destination memory in individuals with a high tendency to deceive (El Haj et al. 2017b; 2017c). According to this research, individuals with a strong tendency to deceive keep track of the destination of both true and incorrect information in order to be consistent in their future social interactions, and thus to avoid discovery of their deception. Taken together, destination memory seems to be influenced by social, cognitive, and affective characteristics of our interlocutors, as well as by our own ability to infer these characteristics during social interactions.

In summary, M&C propose an original account that views episodic memory as a mechanism supporting human communication. According to the authors, episodic recall during social communication serves us in asserting epistemic authority about the past. In our view, this asserting of authority can be further enhanced by remembering to whom information was previously transmitted (e.g., destination memory). Being able to convince others that we are indeed remembering the destination of prior communications is important insofar as it helps us to convince our interlocutors of the accuracy of present communications. Besides its influence on our interlocutors, destination memory can be influenced by our interlocutors (i.e., familiarity of our interlocutors; their social, cognitive, and affective characteristics; and our own ability to infer these characteristics). Together, destination memory and episodic memory in general can be considered not only as a mechanism influencing human communication, but also as a mechanism influenced by this communication. By demonstrating the bidirectional relationship between memory and communication, consideration of destination memory adds to the impressive work by M&C that focuses on how memory influences communication.

Episodic memory and consciousness in antisocial personality disorder and conduct disorder

doi:10.1017/S0140525X17001340, e13

Franco Fabbro[a] and Cristiano Crescentini[b,1]

[a]*Department of Medicine, University of Udine, 33100 Udine, Italy;* [b]*Department of Languages and Literatures, Communication, Education and Society, University of Udine, 33100 Udine, Italy.*

https://people.uniud.it/page/franco.fabbro
cristiano.crescentini@uniud.it
https://people.uniud.it/page/cristiano.crescentini

Abstract: Episodic memory is one of the most significant sources of information of humans. It entails cooperative and linguistic skills and, as Mahr & Csibra (M&C) note, the capacity to ground veridical beliefs about the past. In some psychiatric disorders (antisocial personality disorder and conduct disorder), it was found that the habit of lying is associated with episodic memory and consciousness deficits.

A distinctive feature of human cognition is the tendency for cooperation, which has been linked with the phenomenon of shared intentionality (which includes joint goals and joint attention). The development of human cooperation gave birth, in Homo sapiens, to linguistic communicative cooperation. A key aspect of social cooperation and linguistic communication concerns the commitment, on the part of communicators, to inform others truthfully and accurately (Tattersall 2012).

Information is true in the sense that one should speak independently of their own selfish interests, allowing information to be of benefit to all interlocutors. In addition, human social cooperation is linked with other typical features of human cognition, such as theory of mind (ToM: the ability to attribute mental states such as beliefs, desires, intents, and knowledge to others), and the development of beliefs and social norms related to normative self-monitoring, which allows individuals to operate in accordance with generic group norms in order to protect their public reputation and be considered cooperative group members (Tomasello 2008).

Given that humans can only live within social and cultural groups, whose numeric entities have universal characteristics (Dunbar 1993; 1997), social evaluation of an individual from other members of the group is vital. For this reason, from early childhood children are concerned with what others think of them (Haun & Tomasello 2011). In fact, humans tend to show signs of guilt and shame when their passions or their behaviors, deemed illicit under the rules of the group, are made public (Tomasello 2016).

In their thorough review, Mahr & Csibra (M&C) argue that episodic memory (memory of events and autonoesis) is connected to the ability to ground veridical beliefs about the past. Episodic memory is then connected to the experience of truthful witness, which is one of the most meaningful aspects of language communication. Language, in fact, has been considered to be a suitable system to exchange complex, semantic information, more than a communication system (Fabbro et al. 2015; Jerison 1973; 2002). Thus, it is likely that in hunter-gatherer communities, in which Homo sapiens evolved, the testimony of past experiences constituted a privileged way of transmitting information – for instance, concerning tools and poisons (Lee & Daly 1999).

The argumentations proposed by M&C seem confirmed by previous studies that have investigated cognition and behavior in children and adult patients exhibiting antisocial behavior such as those observed in conduct disorder (CD) or antisocial personality disorder (APD). It has indeed been reported that these individuals show repeated violations of rules, deceitful behavior, aggressive and destructive behavior, and, in particular, a tendency for antisocial lying (i.e., deception for personal gain) and minimizing antisocial behavior (Holmqvist 2008; Iñiguez et al. 2014; Jiang et al. 2013; Pasion et al. 2017; Searight et al. 2001; Talwar & Crossman 2011). Despite being able to identify others' thoughts, desires, and beliefs, subjects with antisocial behavior, such as those documented in CD and APD, may demonstrate a poor ability to understand emotions of others and to recognize inner cognitive beliefs and moral rules (so-called theory of nasty minds; Happe & Frith 1996; Lonigro et al. 2014). Previous studies on the organization of memory and consciousness in patients with CD, APD, or with syndromes with which they share some similarities – such as attention-deficit/hyperactivity disorder (ADHD), major depression, and borderline personality disorder – have confirmed the presence of deficits in episodic memory and consciousness (Fertuck et al. 2006a; 2006b; Holmqvist 2008; Krauel et al. 2007; Quinlan & Brown 2003; Söderlund et al. 2014).

There is a long tradition of studies about how unethical behavior changes beliefs (e.g., the phenomenon of cognitive dissonance). Recently, a series of experiments has been conducted to evaluate the effects of unethical actions on episodic memory. It was shown that episodic memory of unethical actions becomes

https://doi.org/10.1017/S0140525X17000012 Published online by Cambridge University Press

less accessible, vivid, and clear over the time relative to memories of ethical actions or other types of behaviors ("unethical amnesia"; Kouchaki & Gino 2016). Although the mechanisms through which episodic memories of people's unethical acts become obfuscated over time still remain to be fully clarified, it has been proposed that this obfuscation occurs through motivated retrieval-suppression mechanisms that operate to make unwelcome memories of unethical acts less accessible and vivid; this would also contribute to maintenance of one's acceptable self-image (Anderson & Hanslmayr 2014; Freud 1937; Goleman 1985; Kouchaki & Gino 2016).

The degree of truth and congruence of testimonies may depend on the presence or absence of lies. Moreover, many studies have been conducted on the reconstructive nature of episodic memory (Hassabis & Maguire 2009; Schacter 1996) and on the possible limitations of verbal testimony (Michaelian 2016a; Schacter 2001). Also, what is worth noting is the inherent characteristic of the human mind to create stories and theories up to the narration of one's life (autobiographical memory; Deutsch 1997; Gazzaniga 2011; Gottschall 2012). This typical tendency of the linguistic mind, organized in the left cerebral hemisphere (Wolford et al. 2000), has given great opportunities to human beings (including the development of religion and literature), but it is a tendency that must be controlled by means of a critical attitude, which humans have slowly learned to develop within the realm of philosophical and scientific thought (Kahneman 2011; Smolin 2006; 2013).

NOTE

1. Corresponding author.

The sociocultural functions of episodic memory

doi:10.1017/S0140525X17001352, e14

Robyn Fivush

Department of Psychology, Emory University, Atlanta, GA 30322.

psyrf@emory.edu

https://scholarblogs.emory.edu/familynarrativeslab/

Abstract: The functional use of episodic memories to claim epistemic truth must be placed within sociocultural contexts in which certain truths are privileged. Episodic memories are shared, evaluated, and understood within sociocultural interactions, creating both individual and group identities. These negotiated identities provide the foundation from which epistemic claims to truth can be made.

Why do we remember? Mahr & Csibra (M&C) tackle this long-standing philosophical and psychological question by arguing that memories of specific past experiences serve epistemic truth claims; individuals use memories of the personal past to communicate information in order to influence others' beliefs about the world. This communicative function is more successful to the extent that the speaker can provide details of the past episode. I argue that using episodic memories to claim epistemic truth must be placed within sociocultural contexts in which certain truths are privileged (Fivush 2000; 2010b). Epistemic claims do not succeed through level of detail recalled, but through resonance with those who are hearing and validating that recall (Pasupathi et al. 2016). More specifically, epistemic claims are made from a particular historical and sociocultural position in which particular identities are negotiated and validated (Bordo 1990). Thus, I argue that episodic memories primarily serve to define individual and group identity, and much of this is accomplished through socioculturally structured episodic recall of the emotionally evaluative aspects of personal experiences, rather than the facts of what happened. Moreover, the identity functions of episodic memory are embedded in historically and culturally variable contexts that privilege certain epistemic claims to truth over others.

Unquestionably, talk about the past is ubiquitous in everyday interaction. Individuals share daily occurrences and significant life events, disclosing new experiences to friends and family to better understand and evaluate episodes, presenting specific episodic memories to introduce the self to new acquaintances and retelling shared experiences to bond with others through creating a shared history (Beike et al. 2016; Conway et al. 2004). We see this beginning early in development as reminiscing develops within family contexts. Parents draw children into sharing the personal past, and even in the preschool years, these conversations focus on emotions and relationships (Fivush 2007). Substantial research demonstrates, through both observation and parental report, that parents and children share their past together in order to help children create a coherent sense of self and to maintain emotional bonds within the family (Fivush 2007; Kulkofsky et al. 2009). To this end, parents and children focus on creating a shared subjective perspective, reminiscing about their inner worlds, their thoughts, and their feelings. And in families where parents engage in more emotionally elaborated reminiscing with their children, the children develop a more coherent sense of self (Bird & Reese 2006), higher levels of emotional regulation (Laible & Song 2006), and stronger family bonds (Pratt & Fiese 2004). Thus, parent–child reminiscing serves both individual and family identity functions.

Importantly, parent–child reminiscing is culturally variable (Wang 2013). What it means to be a self, to have an identity, and to belong are themselves culturally constructed (Wang 2016), and developmentally, parents are helping their children become competent members of their culture through helping them construct their personal past. For example, in Western cultures, parent–child reminiscing focuses on individual autonomy, whereas, in Eastern cultures, it focuses on a communal sense of self. By middle childhood, children in these different cultures are already recalling their personal past in different ways, constructing and presenting different forms of identity (Han et al. 1998).

These kinds of cultural differences highlight how personal memory is shaped by larger sociocultural frames (McLean & Syed 2015). Cultures define the shape of a life, the significance of certain events, and the appropriate evaluative frameworks for understanding those experiences (Scherman et al. 2017). Thus, individual identity is situated within a cultural or group identity. As adolescents move out into larger sociocultural worlds, having episodic memories that help define them as members of a group is beneficial. Adolescents who have coherent episodic memories that embed them within religious, ethnic, and/or racial groups show higher levels of identity development and higher levels of meaning and purpose in life (Fivush 2013; Hammack 2006). Perhaps more compellingly, adolescents who are unable to embed episodic memories in larger cultural identities show high levels of psychopathology and even suicide (Chandler & Lalonde 1998; Kirmayer et al. 2000). Clearly, the group identity function of episodic memories is critical.

Understanding that episodic memory serves identity functions fundamentally changes how we understand the epistemic function as being as much related to identity as to truth. Episodic memories are constructed within, and are imbued with, cultural worldviews that privilege certain truths (Bordo 1990; Fivush 2010b). Thus, the sociocultural functions of episodic memories provide a foundation for epistemic claims. Of course, cultural worldviews evolve, and paradoxically, often evolve through negotiating and validating individual memories. We can see evidence of this in changing historical perspectives on "truth" such as individual memories of the civil rights movement in the United States (Hall 2005), or the memories recorded for the multiple truth and reconciliation tribunals around the world (Bracken et al. 1995; Pasupathi et al. 2016; Summerfield 1997). Epistemic claims are made in sociocultural contexts that negate, contest,

https://doi.org/10.1017/S0140525X17000012 Published online by Cambridge University Press

silence, or validate those claims (Fivush 2010b). The sociocultural functions of individual and group identity create the contexts within which epistemic claims are evaluated.

These arguments raise the question of how authority emerges to make epistemic claims. M&C argue that the individual with the most detailed episodic content will have epistemic authority, but a sociocultural analysis highlights how authority is negotiated through positioning of one's individual and group identity. M&C raise important questions of how episodic memory is used to assert epistemic truth. I argue for the need to place episodic memories in a sociocultural context that privileges certain truths over others in order to preserve individual and group identity.

"Truth be told" – Semantic memory as the scaffold for veridical communication

doi:10.1017/S0140525X17001364, e15

Brett K. Hayes,[a] Siddharth Ramanan,[b–d] and Muireann Irish[b–d,1]

[a]*School of Psychology, University of New South Wales, Sydney, NSW 2052, Australia;* [b]*Brain and Mind Centre, University of Sydney, Camperdown, Sydney, NSW 2050, Australia;* [c]*School of Psychology, University of Sydney, Camperdown, Sydney, NSW 2050, Australia;* [d]*Australian Research Council Centre for Excellence in Cognition and its Disorders, Sydney, NSW 2109, Australia.*

b.hayes@unsw.edu.au
http://www.psy.unsw.edu.au/contacts-people/academic-staff/professor-brett-hayes
siddharth.ramanan@sydney.edu.au
http://www.ccd.edu.au/people/profile.php?memberID=1492
muireann.irish@sydney.edu.au
https://www.ccd.edu.au/people/profile.php?memberID=683

Abstract: Theoretical accounts placing episodic memory as central to constructive and communicative functions neglect the role of semantic memory. We argue that the decontextualized nature of semantic schemas largely supersedes the computational bottleneck and error-prone nature of episodic memory. Rather, neuroimaging and neuropsychological evidence of episodic-semantic interactions suggest that an integrative framework more accurately captures the mechanisms underpinning social communication.

Mahr & Csibra (M&C) propose a new and provocative account of the content and function of episodic memory. Although a significant contribution to the ongoing debate about the nature and purpose of memory, we see important gaps in their framework.

The main problem is that this account says very little about the relationship between semantic and episodic memory, instead endorsing a sharp distinction between these two types of memory (see M&C Table 1). We outline a number of in-principle arguments and review relevant neuroimaging and neuropsychological evidence to challenge this distinction. By highlighting the close interactions between these memory systems, we place equal emphasis on the importance of semantic memory for the creation and communication of beliefs.

Some types of semantic memories have a strong experiential basis. Personal experiences that are repeated frequently (e.g., doing the weekly grocery shopping) can be stored as event scripts or schemas (Alba & Hasher 1983; Renoult et al. 2012). Such schemas contain the most common elements of repeated experiences. We see at least three ways that these memories interact with episodic memories. First, semantic memories may begin as personal memories of individual episodes that become decontextualized and compiled into schemas over repetitions. Second, schema memories during retrieval can form the foundation for reconstruction of specific episodes. Imagine, for example, that your partner asks you whether an advertised sale has started at the clothing store near your usual supermarket. To answer, you could sample your supermarket-shopping schema to retrieve memories of nearby stores, using these as retrieval cues for details of your most recent visit to the mall.

Perhaps most significantly for the M&C account, semantic memories can serve as "grounds for believing" in social communication. For example, someone may ask which of two grocery stores you think provides the best value for money. Constructing an answer would likely require sampling schemas of shopping at each store (Stewart et al. 2006). Notably, these samples would involve retrieval of abstract impressions of "value" across episodes rather than detailed episodic information. This example illustrates that the decontextualized knowledge in semantic memory is no less important to social communication than episodic memory. In fact, semantic memory serves a crucial communicative function by virtue of its veracity. It strips away episodic memories to preserve the most important elements and hence is less malleable (and error-prone) than episodic memory.

The argument against a strict fractionation between episodic and semantic memory is supported by mounting evidence from the neuroimaging and neuropsychological literature (Greenberg & Verfaellie 2010). Neuroimaging findings of robust activation of semantic processing brain regions during so-called episodic memory tasks (Binder & Desai 2011; Burianová et al. 2010) reveal a close correspondence between episodic and semantic memory on the neuroanatomical level, underscoring the unclear boundaries that exist between these memory systems.

Working from this premise, episodic constructions of the type proposed by M&C should contain a large proportion of semantic concepts (Binder et al. 2009). Neuropsychological evidence from clinical populations supports this assertion. For example, patients with semantic dementia, in which the conceptual knowledge base is progressively eroded, display marked impairments in constructing novel future events, despite a relative preservation of episodic memory (Irish et al. 2012a; 2012b). These impairments in mental simulation are attributable to atrophy of specialized semantic processing regions in the anterior temporal lobes (reviewed by Irish & Piolino 2016). Indeed, semantic representations are posited to underlie a host of other higher-order cognitive processes including language, reasoning, planning, problem solving, and social interaction (Binder et al. 2009).

As M&C note, an unlimited episodic memory store would be highly unfeasible, requiring us to store the minutiae of every event experienced in order to justify any and all inferences that we make. In this regard, the utility of semantic memory becomes apparent – by extracting and retaining the crux of past events, we avail ourselves of undifferentiated information that can be generalized across contexts and scenarios (Lambon Ralph et al. 2010). It is thus possible for us to engage in non-episodic forms of simulation to envisage what the future may hold, without having experienced these events previously (Irish et al. 2016; Klein et al. 2002b).

Considering the communicative function of episodic memory endorsed by M&C, we propose that semantic memory provides the foundation for the veridical telling of events. The persuasive exchange of information will invariably depend upon the accessibility of information that is relevant to the speakers' goals. Rather than placing unwieldy demands upon episodic recollection to support our beliefs, we propose that semantic memory represents a more efficient system with which to flexibly represent and justify beliefs. For example, in reasoning why one should not walk down dark alleyways alone at night, one does not need to have experienced an actual mugging to persuasively communicate this information. Rather, the "computational bottleneck" of the episodic memory system is superseded by the abstracted conceptual knowledge that certain areas of a city may not be safe at night (see also Hegdé 2007). Of course, episodic memory can also be utilized to instill credibility, however, we contend that it is not the limiting factor in this process.

In short, it seems prudent to prioritize the role of semantic memory in the communication of information. Semantic facts are stable; they are passed on through public records, family history, and collective discourse to represent the outcomes of

https://doi.org/10.1017/S0140525X17000012 Published online by Cambridge University Press

inferences and experiences. The essential elements are extracted, providing a foundation that is not subject to the vagaries of episodic context or personal biases. A major challenge then, is to establish a consensus regarding the respective contributions of, and interactions between, episodic and semantic memory with regard to persuasive communication. Rather than positioning these entities as mutually exclusive systems, we conceptualize semantic memory as providing the essential scaffold for constructive endeavours across past, future, and social contexts (Irish & Piguet 2013), and worthy of inclusion in the conversation.

NOTE

1. Corresponding author.

Episodic memory and the witness trump card

doi:10.1017/S0140525X17001376, e16

Jeremy Henry and Carl Craver

Department of Philosophy and Philosophy-Neuroscience-Psychology Program, Washington University, St. Louis, MO 63130.

jeremy.henry@wustl.edu **ccraver@wustl.edu**

https://pages.wustl.edu/cfcraver

Abstract: We accept Mahr & Csibra's (M&C's) causal claim that episodic memory provides humans with the means for evaluating the veracity of reports about non-occurrent events. We reject their evolutionary argument that this is the proper function of episodic memory. We explore three intriguing implications of the causal claim, for cognitive neuropsychology, comparative psychology, and philosophy.

There is no believing a liar, even when he speaks the truth.

—Aesop

Mahr & Csibra's (M&C's) evolutionary hypothesis is that episodic memory has the proper function of signaling and evaluating the veracity of reports about non-occurrent events. This evolutionary hypothesis entails a causal hypothesis: that episodic memory makes a very significant contribution to our ability to tell convincing stories about the past, replete with context and detail, and to our ability to probe those details to test whether the stories others tell us are true. We find the evolutionary hypothesis less compelling and fertile than the causal hypothesis.

We reject M&C's argument in favor of the evolutionary hypothesis. Their argument assumes that among the many things episodic memory allows us to do, just one can be singled out as the dominant cause of its having been selected, that is, that the various hypotheses about episodic memory's proper function are mutually exclusive. We see it as altogether more likely that episodic memory evolved under multiple selection pressures: for witnessing (M&C), for future thought (Schacter et al. 2007), for gossip (Keven 2016a), and for counterfactual reasoning (De Brigard 2014a). The precise features of episodic memory likely reflect a compromise between these selective pressures and sharp design constraints on the set of permissible variations to existing functional parts. It is therefore exceptionally risky to infer the actual causal history of a trait such as episodic memory from its current form. It is comparatively safe to study what episodic memory does here and now, for example, to test the causal hypothesis.

The causal hypothesis is speculative. Its value lies primarily in its ability to suggest new and productive research questions. We consider three such novelties: for neuropsychology, comparative psychology, and philosophy.

From a neuropsychological perspective, individuals with episodic amnesia might be a valuable source of evidence for evaluating the causal hypothesis. Episodic memory and future-oriented episodic thought are typically operationalized by asking participants to tell stories about past, future, or counterfactual events and then counting how many internal (i.e., story-relevant) details they provide. And it is well known that individuals with acquired amnesia generate fewer details in their narratives than do neurotypical humans, supporting the causal hypothesis (Hassabis et al. 2007a; 2007b). That said, it is also known that individuals with perinatal hippocampal damage never develop the capacity for episodic memory and have nonetheless been shown to generate copious detail if properly cued (Hurley et al. 2011; Mullally et al. 2012), though their stories have been reported to lack spatiotemporal coherence. We wonder how M&C would explain this finding. Concerning the second, evaluative, component of the causal hypothesis, it is currently unknown whether individuals with amnesia are generally perceived to be less credible than neurotypical individuals and, perhaps more interestingly, whether individuals with episodic deficits sort veridical from non-veridical testimony comparably to controls. Might an episodic memory deficit, perhaps even from birth, be expected to influence how well one can assess the firsthand testimony of others? The causal hypothesis thus opens new questions about the role episodic simulation might play in the second-order *evaluation* of other people's narratives.

Consider, next, comparative psychology. The causal hypothesis might allow investigators to assess whether nonhuman creatures and preverbal children are truly capable of episodic thought. Controversy in this area stems in part from the fact that there is no accepted behavioral indicator of autonoetic experience. Experimental paradigms used to assess "episodic-like" memory in scrub jays, for example, establish only that they know what they cached, where, and when. Clayton and Dickinson (1998) are forced to call this memorial capacity "episodic-like" precisely because the method cannot establish that the birds reconstruct the caching event or know that they previously cached the seeds. However, if the causal hypothesis is correct, the existence in a group of organisms of a complex set of practices for enforcing veridical and detailed information delivery about non-occurrent events counts as evidence that those organisms have some autonoetic capacity. If, for example, children began to enforce veridical reporting of non-occurrent events prior to the acquisition of verbal language, that would provide some evidence that they keep track of the details of non-occurrent events and hold beliefs about them to epistemic standards. One might view the observation of rich communicative practices as a very high bar for discovering episodic memory. On the other hand, this standard might reveal something unique about episodic memory in humans.

Finally, we turn to philosophy. In many arenas of human social life (friendship, law, journalism, politics, and science), we treat firsthand experience as a special source of knowledge. The witness to the atrocity is treated as knowing things that others cannot; the witness knows them "directly" rather than via testimony. Witnesses hold trump cards: They can speak with authority about certain aspects of the event, whereas non-witnesses cannot. The epistemic value of first-person experience is grounded in a set of social practices (of recognizing, regimenting, and enforcing the telling of truths about the past), and these practices are possible only if creatures in that social group have the capacity to reconstruct events and attribute them to their personal pasts. Even granting the many well-known failures of episodic memory as a reliable source of information about the past (Schacter 2001), the fact that our cognitive systems contain such a mechanism makes it possible for creatures like us to engage in the practices that constitute and sustain the privileging of firsthand experience. The causal hypothesis, in short, points the way to a deeper understanding of how the normative epistemic privilege of first-person experience is made possible by the cognitive mechanisms we possess.

In this case, our understanding of the space of causes (i.e., of the causal mechanisms that populate our neurocognitive apparatus) is linked to our understanding of the space of reasons (i.e., of how we justify our beliefs and actions) through a set of social practices that both create and sustain the norms constitutive of the epistemic privilege of the witness (the witness trump card).

https://doi.org/10.1017/S0140525X17000012 Published online by Cambridge University Press

In our view, this philosophical thought is the core fruit of M&C's highly original target article.

More to episodic memory than epistemic assertion: The role of social bonds and interpersonal connection

doi:10.1017/S0140525X17001388, e17

William Hirst[a] and Gerald Echterhoff[b]

[a]*Department of Psychology, New School for Social Research, New York, NY 10011;* [b]*Social Psychology Group, Department of Psychology, University of Münster, D-48149 Münster, Germany.*

hirst@newschool.edu g.echterhoff@uni-muenster.de

http://geraldechterhoff.com

Abstract: Remembering is dynamically entangled in conversations. The communicative function of episodic memory can be epistemic, as suggested by Mahr & Csibra (M&C). However, remembering can have genuinely social functions, specifically, the creation or consolidation of interpersonal relationships. Autonoesis, a distinct feature of episodic memory, is more likely to have evolved in the service of social binding than of epistemic assertiveness.

Since Tulving's (1985) seminal work, psychologists have treated episodic memories not just as involving the recall of autobiographical events, but critically, as entailing autonoetic consciousness – that is, a "reliving" through acts of remembering. In order to explain why humans possess a memory with this curious property, Mahr & Csibra (M&C) ask what function episodic memory serves over, for instance, event memory. For them, the answer rests in the communicative nature of remembering. When speakers convey episodic memories to listeners – when they state "I remember that I turned off the oven" – they establish epistemic authority and do so in part because of the autonoetic character of the episodic memory. This epistemic authority assures listeners that they can accept, with a reasonable degree of certainty, that the oven was turned off. M&C claim that listeners would be less certain if they were merely told, "I turned off the oven."

We have reservations about this claim. Is there, as M&C aver, more epistemic authority to the statement "I remember turning off the oven" than not only the statement "I turned off the oven," but also the statement "I know that I turned off the oven"? Or to put it another way, why is autonoesis necessary for assertions of epistemic authority, whereas noesis is not, or is so to a lesser degree? To insist "I know that I turned off the oven," one need not remember turning off the oven. One may simply know that checking if the oven is off is part of a complex routine one always goes through when leaving the house. Many people may believe the assurance of a well-established routine over reports of specific recollections told from a first-person perspective. After all, by virtue of personal experience and metacognitive insight, people have a sense of the potential fallibility of memory (Ryan & See 1993). Moreover, with recurrent coverage in mass media and public education, the unreliability of memory has increasingly become common knowledge. Additionally, conversational rules captured by the maxim of quantity and relevance (Sperber & Wilson 1986) may lead listeners to wonder why the speaker uses an additional, essentially unnecessary qualifier like "I remember" to assert the truth of a proposition.

We have, however, a stronger reservation about the epistemic authority putatively granted by episodic memory. For us, M&C's focus on the epistemic functions of remembering is too myopic. As scholars have noted, the functions of episodic memory reach beyond the epistemic (e.g., Bluck et al. 2005; Hirst & Echterhoff 2012). Critically, remembering can have a social function, in that it can serve to bind together speaker and listener. A couple reminiscing about their first date might not be terribly concerned about conveying new information to each other or even verifying their recollections. The conversation is not about epistemic authority. Rather, the conversation is undertaken to enhance intimacy.

M&C touch on the social functions of remembering when they discuss "social commitments." For instance, people often promise that they will do something. Saying that "I remember that you fulfilled your promise" becomes a means of asserting epistemic authority as to the fulfillment of (or failure to fulfill) a social commitment. But, as our example of a couple reminiscing indicates, the social function of communicative remembering goes far beyond its role in ensuring social commitments. Social relations are much more than contractual arrangements. Indeed, many of the social relationships people value – between themselves and lovers, friends, or even business colleagues – are better characterized in terms of emotional connections than contractual agreements. Communicative acts of remembering not only allow one to keep account of social commitments, but also they can enhance the sense of interpersonal connectedness.

In contrast to the questionable need for autonoesis to grant epistemic authority, there is little question that autonoesis is needed if remembering is to foster social bonding. Joint reminiscing simply could not accomplish this function if the relevant parties were not jointly re-experiencing the remembered event. The intimacy created between John and Jane as they jointly recount their first date depends on their jointly reliving that date. They must both be autonoetically conscious that their memory concerns an event that happened to them. Indeed, assertion of epistemic authority might even ruin the moment.

Moreover, whereas mnemonic reliability is critical in epistemic claims of remembering, remembering does not have to be viewed as, or actually be, reliable to enhance social bonds. After all, it is through the unreliability and malleability of memory that relationally motivated joint recollections reshape the memories of relevant parties and thereby lead to a convergence on a shared representation of the past (Hirst & Echterhoff 2012). As a result of their conversation, John and Jane come to remember their first date in the same way, not because they jointly assess the validity of the claim, but because Jane implants a memory into John, or John induces Jane to forget particular details as he fails to mention them.

In this way, acts of remembering allow the creation of a collective memory and a shared reality and, in turn, enhance human sociality (Echterhoff et al. 2009a; Hirst 2014). M&C failed to appreciate this outcome. For instance, the passages on communication effects on memory (sect. 3.1.2 in the target article) misrepresent underlying motivational processes (see Echterhoff et al. 2009a). There is no evidence that these effects are driven by reputational concerns. Rather, tailoring one's communication to the audience for reasons other than shared-reality creation, such as reputation management, is likely to *eliminate* the effects (Echterhoff et al. 2008).

The curious property of autonoesis, then, may have as much to do with the social, as opposed to the epistemic, functions of remembering. Indeed, for us, it is not surprising that, inasmuch as human being are "ultrasocial" (Campbell 1983), something as distinctively human as the autonoetic character of episodic memory may rest in part on the social functions of remembering.

Encoding third-person epistemic states contributes to episodic reconstruction of memories

doi:10.1017/S0140525X1700139X, e18

Dora Kampis,[a] András Keszei,[b] and Ildikó Király[a,c,1]

[a]*Department of Cognitive Science, CEU, Budapest, 1051 Hungary;* [b]*Institute of Sociology, Pázmány Péter Catholic University, Budapest, 1088 Hungary;* [c]*Department of Cognitive Psychology, ELTE, 1064 Budapest, Hungary.*

https://doi.org/10.1017/S0140525X17000012 Published online by Cambridge University Press

kampis_dora@phd.ceu.edu,
https://cognitivescience.ceu.edu/people/dora-kampis-1
keszei.andras@btk.ppke.hu
kiralyi@caesar.elte.hu
http://babalabor.hu/munkatarsak/dr-kiraly-ildiko/?lang=en

Abstract: We propose an extension to Mahr & Csibra's (M&C's) theory. For successful episodic memory formation, potentially relevant aspects of a situation need to be identified and encoded *online* and retained for prospective interactions. To be maximally convincing, the communicator not only has to encode not just *any* contextual detail, but also has to track information *in relation to* social partners.

Mahr & Csibra (M&C) propose that the main function of episodic memory is to create reliable information packages through episodic reconstruction in order to convince others about the authenticity of a certain statement. Although the account offered does not make any predictions about the mechanisms involved, M&C argue that "the main achievements in episodic memory development occur as a consequence of the development of retrieval mechanisms" (sect. 4, para. 5). Consequently, they leave open the relationship between the characteristics of encoding and retrieval processes.

We propose that an extension of the present theory may be fruitful with regard to the *encoding* of memory traces that later may become constituents of episodic memories. As retrieval is a search among memory traces, it is necessary that the selection process of elements that are encoded is determined by the same factors that later trigger and guide the construction of episodic memories (Tulving & Thomson 1973; Wagner et al. 1998). If the role of episodic memories is to provide proof for reliable information through asserting epistemic authority, and as M&C argue, "contextual elements that … make verification possible … allow one to be perceived as more convincing" (sect. 3.1.1, para. 7), then parts of a situation that may make reporting it later as authentic should be more likely encoded in the first place.

According to M&C's proposal, episodic memory is useful for keeping social commitments, an essential part of human social life. Recalling an episodic memory aims to serve as justification for the authentic nature of our belief, and it may be scrutinized by our interlocutor. Therefore, we can apply self-directed epistemic vigilance beforehand to assess the likelihood that the interlocutor would accept the content as legitimate. In their conceptualization, following the argument of Cosmides and Tooby (2000), in human communicative interactions it is useful to maintain the causal history of first-person beliefs.

We suggest that in order to retain the causal history of beliefs, encoding processes need to be sensitive to potential aspects of a situation that can be retrieved when an episodic memory is formed – which also enables avoiding assertions that would lead the social partner to decline our claims of epistemic authority. This applies to the causal history of first-person beliefs that M&C discuss, but it is also necessary with regard to third-person beliefs. The latter is especially important because, although it may happen that we have no prior communicative episode with the social partner, assertions of epistemic authority are in fact often preceded by a history of interactions with the addressee.

This notion appears in M&C's examples as well (e.g., sect. 3.1.1, para. 1): John and Jenny are on a walk, and Jenny expresses her belief that they might have left the oven on at home. John replies, "Don't worry, I remember that we turned it off." In this communicative episode, the reference to remembering makes Jenny both (1) accept John's belief as true and (2) change her own belief as well. However, this assertion may not be as effective if Jenny had also expressed that her worries emerged from remembering that she saw the oven working right before they left the apartment; if Jenny did not remember that John has indeed been in the kitchen that morning; or especially if she had reasons to think that John in fact *did not* go into the kitchen. Consequently, for such arguments to be successful, it is necessary that the communicator not only retrieve and use information about the source of her or his first-person beliefs, but also select information potentially relevant and adequate for persuading the partner, which could be done only in relation to the communicative partner's access to the events in question.

For successful construction of episodic memories that are used in communication, one therefore often has to encode not just *any* contextual detail, but track information *in relation to* a specific social partner. To later recall information that is relevant for that social partner, one must – at the time a specific episode takes place – select, encode, and store (and, often, *index*) – those elements to a specific person. Additionally, one must take into account any aspects of the event that may potentially contribute to the later construction of the episodic memory related to that communication encounter.

A further challenge is to describe what enables the identification of relevant memory traces at reconstruction. M&C argue that episodic memory requires not only the understanding that seeing leads to knowing, but further that seeing validates claims about knowledge. We propose that in order to bridge encoding and retrieval, online theory of mind (by which we mean real-time, continuous belief monitoring) has to support the encoding of information potentially relevant to the basis of belief formation. Episodic memory "hooks" onto these elements (of the causal history of belief formation for the social partner's belief), and if a later cue refers to these bases of previously formed (attributed) beliefs, this enables the collection of adequate components of episodic memory. Importantly, this process requires the reidentification of the social partner, and the attribution of the social knowledge base and monitoring of potential differences between the self and the partner. Altogether, this mechanism increases the (perceived) veridicality of episodic beliefs reported in a communicative interaction.

The suggested interdependence between episodic memory and theory of mind opens novel perspectives with regard to the developmental trajectory of both domains. Namely, the emergence of episodic memory retrieval would be bootstrapped by communicative situations (e.g., Southgate et al. 2010) especially when mindreading is involved; and relatedly, the mindreading system could learn to update previously attributed beliefs according to relevant new information (Király et al., in preparation) through the emergence of episodic memory.

NOTE

1. Corresponding author.

Carving event and episodic memory at their joints

doi:10.1017/S0140525X17001406, e19

Nazim Keven

Department of Philosophy, Bilkent University, TR-06800 Bilkent, Ankara, Turkey.

nazimkeven@bilkent.edu.tr **http://www.sci-phi.com**

Abstract: Mahr & Csibra (M&C) argue that event and episodic memories share the same scenario construction process. I think this way of carving up the distinction throws the baby out with the bathwater. If there is a substantive difference between event and episodic memory, it is based on a difference in the construction process and how they are organized, respectively.

In the target article, Mahr & Csibra (M&C) challenge overly cognitive accounts of episodic memory based on the mental time travel metaphor. Instead, they offer a social-cognitive function of episodic memory in terms of an epistemic attitude that signals testimonial authority in human communications. I applaud the proposed shift in focus toward the social-cognitive functions of

https://doi.org/10.1017/S0140525X17000012 Published online by Cambridge University Press

episodic memory, and I suspect that M&C's suggestion may not be the only function of episodic memory in the social domain.

M&C also propose a distinction between event and episodic memory. As they mention, and as I have argued elsewhere (Keven 2016b), the distinction has the potential to resolve the long-lasting debate about whether episodic memory is a uniquely human capacity. If the distinction is proven to be robust, we can understand the mnemonic abilities of young children and nonhuman animals with event memory without ascribing to them a capacity for full-blown episodic memory. However, it is not clear how to distinguish event and episodic memory at this stage. M&C suggest that event and episodic memory share the same scenario construction process, whereas I think the type of construction involved in episodic memory is *different in kind* from that of event memory. We can distinguish at least four different types of organization that could be utilized in memory reconstructions:

1. **Spatial organization:** We perceive the world in a spatially organized way and can recall our experiences as such.
2. **Temporal organization:** Experiences occur sequentially in time, such as before or after another event. When we reconstruct an experience from memory, the events should occur in their proper place in the sequence.
3. **Causal organization:** Events can be distant in time and yet can have causal connections with each other. I remember that I missed my bus to Istanbul because my alarm didn't ring. Missing the bus and the malfunctioning alarm clock are two temporally distant events that are causally connected in my memory reconstruction.
4. **Teleological organization:** Temporally distant and causally disparate events can still be connected with each other based on goals. For instance, I remember that I was going to give a talk when I missed the bus, so I took a plane instead to get there in time. Although giving a talk is temporally distant and causally disparate from the malfunctioning alarm clock and missing the bus, it is still connected to them in my memory as my goal at the time.

In M&C's view, both event and episodic memory involve construction of a scenario that involves simulation of events that are extended in time and space. It is not clear whether these simulations involve all of these four types of organization. If they want to maintain that young children and other nonhuman animals have event memories, however, then there have to be some differences in the construction of event and episodic memories. Even though there is some evidence that nonhuman animals can be sensitive to temporal information (e.g., Babb & Crystal 2006; Clayton & Dickinson 1998), it is far from clear whether this amounts to an ability to temporally sequence events into before and after relations (McCormack & Hoerl 2011; Roberts & Feeney 2009). Moreover, causal understanding of our primate cousins is very limited, and no nonhuman animals seem to understand the behavior of others in terms of goals (Penn & Povinelli 2007; Penn et al. 2008; Povinelli 2000; Tomasello et al. 2005; Visalberghi & Tomasello 1998). Similarly, young children show less temporal sequence knowledge and omit causal relations between events in their recall of novel experiences, and their memory representations are not organized around goals to the same extent as are older children's and adults (e.g., Price & Goodman 1990; Ratner et al. 1986). So, it is unlikely that event memories in young children and nonhuman animals can involve temporal, causal, and teleological organization.

In earlier work (Keven 2016b), I provided evidence and argued in favor of carving up event and episodic memory in a different way. According to the dual systems thesis that I proposed, event memory is a snapshot-like memory system based on perceptual processes predominantly in the form of visual images. These perceptually grounded representations are highly accurate but short-lived. Construed as such, event memories involve only spatial organization. Any other type of organization is not necessary in this case, as there are no series of events that are extended in space and time.

However, construction of episodic memories requires a higher order *inferential process*. Episodes generally consist of a series of events that are extended across different times and places. When I remember the missing-the-bus episode, I don't remember all of the minute details involved in the actual experience; I remember only the causally and teleologically relevant ones in the right temporal order. To connect such a series of events, the construction process needs to sort the events into cause and effect and goal-attempt-outcome relations, besides keeping track of each scene's spatial structure and the event's temporal order. Organizing memories in this way requires making higher-order inferences on the relations between events from memory as these relations are not directly observable. According to the dual systems thesis, this inferential process is closely tied to our storytelling capacity as narrative has nearly all of the organizational components one would expect. Reconstructing a narrative version of the experience provides the required temporal, causal, and teleological organization. As such, episodic memories are lower in accuracy but can span longer timescales and are more memorable.

To sum up, when we consider different types of organization that can be utilized in memory reconstructions, construction of event and episodic memories differ in kind. In particular, the construction of episodic memories requires a higher-order inferential process, which is unlikely to be found in event memories.

Episodic memory solves both social and nonsocial problems, and evolved to fulfill many different functions

doi:10.1017/S0140525X17001418, e20

Raymond A. Mar[a] and R. Nathan Spreng[b,c]

[a]*Department of Psychology, York University, Toronto, ON, M3J 1P3 Canada;* [b]*Montreal Neurological Institute, Department of Neurology and Neurosurgery, McGill University, Montreal, QC, H3A 2B4, Canada;* [c]*Department of Human Development, Cornell University, Ithaca, NY 14853.*

mar@yorku.ca **yorku.ca/mar**

nathan.spreng@gmail.com **http://lbc.human.cornell.edu**

Abstract: The episodic memory system is flexible and complex, and likely evolved in response to a wide range of survival-relevant problems in our evolutionary past, both social and nonsocial. Episodic memory allows us to recollect and infer details that may have seemed trivial on encoding, but are now known to be relevant. This memory aids humans in navigating their uncertain environment.

The target article argues that episodic memory plays an important role in social relations. We wholeheartedly agree, having discussed this association in past work, as have others. The unique contribution of the target article is its proposal that episodic memory evolved to support compelling testimony in the service of social persuasion. This strikes us as an unsuitably narrow characterization of episodic memory. The initial premise that led to this characterization, that episodic memory evolved to solve just one problem, appears to be at fault. There is little reason to believe that episodic memory would be tied to a single survival-relevant problem in our evolutionary history. In contrast, it seems logical that flexible and complex brain networks capable of solving a diverse array of problems would be more likely to survive natural selection compared to systems that solve only one problem. The distributed heteromodal cortical "real estate" that comprises brain networks, like the one that supports episodic memory, carries a high metabolic cost (Raichle 2010). As a result, this high cost is likely balanced by a flexible network that can serve numerous functions, providing many benefits and not just one.

https://doi.org/10.1017/S0140525X17000012 Published online by Cambridge University Press

This is consistent with what we know about episodic memory, which flexibly draws upon several more specific cognitive processes depending on the current goals and context. It is no coincidence that the episodic memory network bears similarity to so many other processes, including future thinking, theory-of-mind, narrative comprehension, and spatial navigation (Spreng et al. 2009). Even the shared network that likely underlies all of these different processes, the default network, appears to consist of at least two interacting subsystems that broadly dissociate recollection from inference (Andrews-Hanna et al. 2014). Although these processes are well-integrated and mutually informative, their presence and interaction are not consistent with a single monolithic function for episodic memory.

The varied social deficits experienced by those with compromised episodic memory is also inconsistent with the idea that episodic memory serves a single social function. Amnestic patients are not only likely to experience difficulty recalling single events, reducing the persuasive efficacy of testimony as predicted by the target article, but also they experience a multitude of other social deficits. This includes reduced empathy and helping behavior (Beadle et al. 2013) and smaller social network size (Davidson et al. 2012). Moreover, the hippocampus – a region central to episodic memory – has been found to be involved in encoding many forms of social information, such as the interaction of power and affiliation (Tavares et al. 2015) as well as social rank (Kumaran et al. 2016). These findings are more congruent with the idea that episodic memory supports a wide variety of social functions including those unrelated to persuasion.

Based on this evidence, we believe that episodic memory is unlikely to have evolved solely to provide testimony for the purposes of persuasion. Rather, we propose a novel and alternative characterization: Episodic memory evolved to bring incidental past information to mind in order to solve unanticipated survival-relevant problems. This is immensely useful for humans, who operate in complex and uncertain environments where problems cannot always be predicted and prepared for. Because we do not always know what information will be important in the future, directed attention alone cannot encode all that we will need to solve future problems. This is what makes episodic memory so powerful. By allowing us to re-create experience through a combination of recollection and constructive processes, supported by reasoned inference and associations, we are able to bring far more of the past to bear on current problems than would be possible with deliberate encoding alone. This is a great asset for solving unexpected problems, both social and nonsocial in nature. For example, if we discover that a coworker is upset with us when no associated transgression seems obvious, episodic memory allows us to replay past interactions and search for possible causes. Even if you hadn't realized an error at the time, by re-experiencing these past interactions we may well discover some subtle gaffe from the past. Episodic memory also helps us solve non-social problems, such as finding a misplaced smartphone by retracing one's steps. Importantly, in both examples, we have no idea that the key information is going to be useful in advance. However, episodic memory allows this information to be brought to mind through reconstruction and re-experiencing, using inferences to fill in what was not encoded. Because episodic memory succeeds in reproducing a great deal of information that seems trivial at the time of encoding, when this information suddenly becomes relevant and important for a current problem it is now available through a process of reconstruction and inference.

It is likely no coincidence that one of the most powerful mnemonic techniques for remembering a list of unrelated items is to imagine moving through a familiar space, placing these items throughout (the method of loci; Yates 1966). This technique leverages the power of our episodic memory to embed trivial information within a rich context of associations involving temporal order, spatial context, and interaction with the self. In a sense, it reverse-engineers what our episodic memory is doing for us all the time: trying to remember as much as possible about our experience in case something becomes important later on. This ability is key for survival in the uncertain conditions within which we operate; we don't always know what information is going to be important later on.

In closing, we agree that episodic memory plays a central role in social cognition. In fact, the "social brain" appears more closely aligned with the episodic memory system than with the attentional or perceptual systems (Spreng & Andrews-Hanna 2015). It makes sense that our social milieu is a primary reason why our environment is so uncertain, as our most relevant context involves autonomous agents who are naturally less predictable than the physical environment. That said, we believe it would be an error to conclude from this that episodic memory evolved to solve only social problems or just one particular social problem (i.e., testimony to persuade others).

Using episodic memory to gauge implicit and/or indeterminate social commitments

doi:10.1017/S0140525X1700142X, e21

John Michael,[a] Marcell Székely,[b] and Wayne Christensen[a]
[a]*Department of Philosophy, University of Warwick, Coventry, CV4 7AL United Kingdom;* [b]*Department of Cognitive Science, Central European University, Budapest, 1051 Hungary.*
j.michael.2@warwick.ac.uk
http://www2.warwick.ac.uk/fac/soc/philosophy/people/michael/
szekelymarcell@gmail.com **wayne.christensen@gmail.com**

Abstract: In discussing Mahr & Csibra's (M&C's) observations about the role of episodic memory in grounding social commitments, we propose that episodic memory is especially useful for gauging cases of implicit commitment and cases in which the content of a commitment is indeterminate. We conclude with some thoughts about how commitment may relate to the evolution of episodic memory.

As Mahr & Csibra (M&C) point out, in enforcing the obligations and entitlements generated by social commitments, it can be useful for the parties involved to be able to refer back to the specific occurrence establishing the commitment. In discussing this analysis, we propose that episodic memory is especially useful when gauging cases of implicit commitment and cases in which the content of a commitment is indeterminate.

In cases of implicit commitment, it can be important to be able to remember specific details of a past occurrence in order to determine whether there is a commitment and what it involves (Michael et al. 2016a; 2016b). For example, if Susan proposed to Alan that they go to the cinema on Thursday night, and the conversation takes place as she drives him home from the mechanic's, where his car has been left for major repairs, Alan might interpret Susan's proposal as implicitly including the suggestion that she will pick him up and drive him to the cinema. He might later gently and gracefully ask whether she can pick him up as a way of confirming this and making it explicit.

For commitments with an indeterminate content, remembering the details of a past occurrence can be important in helping delineate what the commitment involves. For instance, as Susan drove Alan home from the mechanic's she offered to help out while his car is in the shop. As he thinks about it later, Alan may be unsure just what he should take this offer to include. Did he mention that public transport from his house to work is terrible *before* she made the offer or *after*? If before, he's got some reason to think Susan is comfortable with the idea of giving him lifts to work. If after, and the topic of conversation moved smoothly on with no explicit suggestion from her that she give him lifts to work, then he's got some reason to think she's not keen on the idea.

In the context of M&C's theory, the importance of episodic memory in human commitment practices raises the question of

https://doi.org/10.1017/S0140525X17000012 Published online by Cambridge University Press

whether episodic memory might show some functional adaptation to facilitate commitment. Specifically, might there be a propensity for stronger encoding of or retention of episodic memories that are commitment related? This could be tested – following a procedure developed by Conway (2009; cf. Williams et al. 2008) – by asking people to list as many specific memories as possible for yesterday, two days ago, three days ago, and so on, and measuring the frequency of memories in which social commitments are generated. In order to determine whether there is commitment-specific facilitation, it would be important to compare the effects of commitment on memory with other factors such as generalized personal or social significance. Should commitment-specific facilitation be found, the further question would be whether this is an evolutionary adaptation, and it would be important to rule out alternative explanations such as enculturation operating on developmental plasticity. It is in general challenging to infer back from current function to evolutionary adaptation, and especially so in the case of multifunctional traits.

With this cautionary note in mind, we may venture to observe that Conway's theory of episodic memory also raises interesting considerations for understanding the origins of commitment in human evolution. Conway's hypothesis is that the function of episodic memory is to maintain a record of progress in relation to short-term goals (Conway 2009). In this respect, it is important to note that active working memory has limited capacity, which means that over the course of temporally extended goal-directed activities, task-related information must be stored and retrieved from long-term memory (LTM). There are compelling reasons to think that the form of LTM involved is episodic memory (self-involving) and not mere event memory (no self present). After all, Alan must be aware that X is *his* goal and that *he* has performed a particular set of task-related actions up to this point. Merely remembering that *some* agent was performing a task, which the individual somehow egocentrically remembers, isn't enough to carry on with the task.

Complex, temporally extended goal-directed activities arguably play an important adaptive role for a number of nonhuman species, and clearly were extremely important in human evolution. This lends considerable plausibility to Conway's theory. More recently (in phylogenetic terms), human lifeways have been shaped by the importance of coordinating with others in *joint* goal-directed activities. It is therefore tempting, against the backdrop of Conway's theory, to speculate that episodic memory may have come to support the function of keeping track of who is committed to what within the context of joint goal-directed activities. Could such information be encoded directly to semantic memory, bypassing episodic memory? Possibly, but on Conway's account, episodic memory forms the basis for higher-order conceptual memory structures (e.g., a conceptual frame like *a day at work*) that provide narrative structure which organizes specific episodes. Thus, according to Conway, episodic memory plays a foundational role in the development of higher levels of narratively structured memory.

Conway's theory offers an attractive framework for understanding the evolution of social commitment and, in so doing, provides an illuminating backdrop to M&C's analysis. As M&C point out, episodic memory is important in grounding social commitments. This is surely true. It is also true that, to make a commitment, you have to already be capable of engaging in temporally extended goal-directed activity – otherwise there is nothing to make a commitment about. Furthermore, the social regulation of commitments (especially to the extent that the commitment is implicit and/or indeterminate) is likely to involve the detailed narrative memory for goal-directed activity described by Conway's theory.

Autonoesis and reconstruction in episodic memory: Is remembering systematically misleading?

doi:10.1017/S0140525X17001431, e22

Kourken Michaelian

Department of Philosophy, University of Otago, Dunedin 9054, New Zealand.
kourken.michaelian@otago.ac.nz **http://phil-mem.org/**

Abstract: Mahr & Csibra (M&C) view autonoesis as being essential to episodic memories and construction as being essential to the process of episodic remembering. These views imply that episodic memory is systematically misleading, not because it often misinforms us about the past, but rather because it often misinforms us about how it informs us about the past.

Mahr & Csibra (M&C) argue that the function of episodic memory is to enable a subject to persuade others to endorse the subject's descriptions of past events. Although the authors build an impressive case for this communicative account, it turns out to be committed to a counterintuitive claim, namely, that episodic memory is systematically misleading. Other accounts, including the future-oriented account (e.g., Schacter & Addis 2007), likewise turn out to be committed to this *misleadingness claim*. The future-oriented account sees episodic memory, along with episodic future thought (Szpunar 2010), as a form of mental time travel (MTT) (Suddendorf & Corballis 1997), with future-oriented MTT or episodic future thought being primary, in the sense that the function of the MTT system is to enable the subject to imagine future events, while the ability to engage in forms of past-oriented MTT, including episodic memory, emerges as a by-product. Although they differ on the question of the function of the memory or MTT system, the future-oriented account and the communicative account agree on two claims that together imply the misleadingness claim: (1) that episodic memories necessarily involve autonoesis (the *autonoesis claim*) and (2) that episodic remembering is necessarily a constructive process (the *construction claim*).

The autonoesis claim: M&C understand autonoesis in metarepresentational terms (cf. Dokic 2014; Fernández 2016), characterizing the content of a retrieved memory as having two components: a first-order component informing a subject about an event and a second-order component informing him or her that the information provided by the first-order component originates in the subject's own experience of the event. If retrieved memories are indeed metarepresentational, then, when retrieval results in the formation of a belief, the subject believes not simply that such-and-such an event occurred but rather that he or she knows that such-and-such an event occurred because of having experienced its occurrence. Crucially, the second-order component of a memory belief might be inaccurate – and hence the belief as a whole might be false – even if the first-order component is accurate, simply because there are sources of accurate information about an event other than one's own experience.

The autonoesis claim is essential to the communicative account: In making a memory claim, a subject claims epistemic authority over the event in question, and autonoesis is normally the subject's only ground for doing so. The claim might not, strictly speaking, be essential to the future-oriented account: Because autonoesis may not play a role in episodic future thinking (Perrin 2016), the future-oriented account might replace it with a weaker claim, namely, that although autonoesis typically plays a role in episodic remembering, it is not a necessary feature of retrieved memories (Michaelian 2016b). Even this weakened claim is, however, sufficient to commit the future-oriented account to the misleadingness claim.

https://doi.org/10.1017/S0140525X17000012 Published online by Cambridge University Press

The construction claim: M&C understand construction as occurring through Bayesian prediction of features of past events based on evidence provided by both episodic traces and semantic information (De Brigard 2014a). Alternative understandings are available (Michaelian 2016b), but they concur that, at least in typical cases, not all of the content of a given retrieved memory originates in the subject's experience of the remembered event. This, in turn, implies that retrieved memories will often be, to some degree, inaccurate with respect to remembered events. But construction does not make inaccuracy inevitable: The incorporation of nonexperiential information into a retrieved memory representation, in particular, does not necessarily imply inaccuracy, simply because incorporated information may itself be accurate (Michaelian 2013).

The construction claim is essential to the communicative account: If the point of making memory claims is not to convey accurate descriptions of past events but rather to convey descriptions that the subject wants an audience to endorse, a constructive memory process is needed to enable the subject to generate suitable representations of events. The claim is likewise essential to the future-oriented account: The MTT system must be able to constructively recombine and modify information from various sources in order to generate representations of possible events in episodic future thinking, and if episodic remembering is carried out by the same system, it is bound to be constructive in the same sense.

The misleadingness claim: Together, the (weakened) autonoesis claim and the construction claim imply the misleadingness claim. If the autonoesis claim is right, a memory might be false even if the event that it represents occurred exactly as the belief represents it as having occurred. In particular, the belief will be false in cases in which its first-order content originates at least in part in a source other than the subject's own experience of the event. If the construction claim is right, such cases occur frequently. Indeed, because, as M&C acknowledge, episodic remembering is driven as much by current beliefs as by episodic traces, they are the rule rather than the exception. Therefore, the second-order component of a memory belief – and the belief as a whole – will frequently be false. In short, both the communicative account and the future-oriented account are committed to the claim that episodic memory beliefs are frequently false, not because construction results in inaccurate representations of events, but rather because autonoesis results in inaccurate metarepresentations of the relationship between representations and the sources in which they originate, both where events are represented inaccurately and where they are represented accurately.

We might, in principle, attempt to avoid the misleadingness claim by rejecting either the construction claim or the autonoesis claim, but we have good reason to accept both of these claims. We might also attempt to avoid it by modifying the metarepresentational understanding of autonoesis so that the autonoesis claim says that the second-order component of a retrieved memory informs a subject only that part of the first-order component of the memory, as opposed to the first-order component as a whole, originates in the subject's experience of the event, but it is unclear whether this is compatible with the roles assigned to autonoesis by the communicative and future-oriented accounts. We may thus be forced to accept the counterintuitive conclusion that episodic memory is indeed systematically misleading.

Autonoesis and dissociative identity disorder

doi:10.1017/S0140525X17001558, e23

John Morton

Institute of Cognitive Neuroscience, University College, London WC1N 3AR, England.

j.morton@ucl.ac.uk **https://johnmorton.co.uk/**

Abstract: Dissociative identity disorder is characterised by the presence in one individual of two or more alternative personality states (alters). For such individuals, the memory representation of a particular event can have full episodic, autonoetic status for one alter, while having the status of knowledge or even being inaccessible to a second alter. This phenomenon appears to create difficulties for a purely representational theory and is presented to Mahr & Csibra (M&C) for their consideration.

A good test of a framework is the way in which it handles rare cases. The challenging example I wish to introduce for Mahr & Csibra's (M&C's) consideration is that of the episodic memory of individuals with dissociative identity disorder.

The *Diagnostic and Statistical Manual of Mental Disorders* (5th ed.; *DSM-V*) diagnostic category for dissociative identity disorder (DID) has two main criteria:

> A. Disruption of identity characterized by two or more distinct personality states. …
>
> B. Recurrent gaps in the recall of everyday events, important personal information, and for traumatic events that are inconsistent with ordinary forgetting. (American Psychiatric Association 2013, p. 292)

Other criteria include the ruling out of cultural factors and general medical conditions. Any gap in the recall of everyday events is usually filled by the recall of another personality state. Thus, detail of the previous day's activities might be traced by piecing together the (non-overlapping) episodic recall of three or four alters.

With DID patients, then, the phenomenon of interest relates to what one alternative personality state (alter) knows about what happened to another alter. One experimental demonstration of this involves an alter learning 24 nouns. A second alter, who denies all knowledge of the preceding procedure, is taught a different set of nouns. A week later, without warning, the second alter is brought out and asked to follow a recognition memory test with the 48 stimuli together with distractors. Huntjens et al. (2003; 2007) found that their DID subjects responded to the words presented to the other alter as though they had previously seen them, in spite of having no recollection of the presentation. These authors conclude that "dissociators … seem to be characterised by the *belief* of being unable to recall information instead of an actual retrieval inability" (2007, p. 788, their italics). This situation, where there is no phenomenal experience of an event, but where the event is exerting a clear influence on behaviour, matches the phenomenon of post-hypnotic amnesia (e.g., Smith et al. 2013). Here, subjects claim no recollection of recent experiences which, nonetheless, affect current behaviour. Smith et al. (2013) have suggested that executive processes are responsible for controlling the initial access to material and then determine whether retrieved information is allowed into consciousness. However, material that has been accessed will exert some influence on processing even though it is not allowed into consciousness. Morton (2017) gives a similar account for the results of Huntjens et al. (2003; 2012) described above.

Using the same experimental procedure as Huntjens et al. (2003), Morton (2012; 2017) found two individuals with DID where one alter responded to the words that had been presented to another alter in exactly the same way as they responded to the control words. In other words, this material could not even be accessed by the second alter despite being a full part of the first alter's phenomenal past.

Similar results have been shown with more complex material. Reinders et al. (2003) studied DID patients who were in either a trauma-related identity state or a neutral identity state. The former generated an autobiographical traumatic memory that the latter failed to recognise as relating to themselves. These memories were contrasted to neutral memory scripts, which both states accepted as autobiographical. The two scripts were put into the third person and read in a neutral tone to the patients while they were in a scanner. The scans were similar with the neutral script for the two states, and there were only small differences between the scans of the two scripts for the neutral identity state. The big difference occurred when the trauma-related state

https://doi.org/10.1017/S0140525X17000012 Published online by Cambridge University Press

listened to the trauma script. Note that not only did the neutral identity states claim they did not recognise the trauma story as relevant to themselves, but also their brain response backed that up; there was an amnesic barrier between the alters.

The possible problem for the M&C position, then, is that an episodic memory, fully self-referential and autonoetic when accessed by one alter, behaves totally differently when accessed by another alter. In some cases, the material is treated as knowledge, and in other cases it is treated as though it does not exist. This seems to create problems if the differences between episodic memory, event memory, and beliefs are simply there in the representations, as M&C seem to claim. The alternative way of thinking about this seeming paradox has two components. First, the emphasis would be on meta-cognitive processes: what other people refer to as executive processes. This is distinct from the metarepresentational format referred to by M&C, which would be seen as the product of current processing. The second component is the retrieval process itself. If one thinks in terms of context-sensitive memory (e.g., Godden & Baddeley 1975), it is natural to treat some notion of *self* as a part of the addressable section of a memory representation. This would have a normal use of distinguishing between representations of events that were first- or secondhand. Its interpretation by the executive (meta-cognitive) processes would give rise to autonoesis.

Within such a framework, the treatment of the DID case is straightforward as outlined above. Executive processes use the *self* marker specific to the alter that is currently active either to restrict whether material can be made conscious or, in other cases, whether the memory representations can be accessed at all. In this way a particular representation can either have an autonoetic character or not. The apparent paradox is solved here by the use of processing. It is not immediately apparent how a representational view such as that put forward by M&C would deal with it. I leave it in their hands.

Epistemic authority, episodic memory, and the sense of self

doi:10.1017/S0140525X17001443, e24

Jennifer Nagel

Department of Philosophy, University of Toronto, Toronto, ON, M5R 2M8, Canada.

jennifer.nagel@utoronto.ca

http://individual.utoronto.ca/jnagel/Home_Page.html

Abstract: The distinctive feature of episodic memory is autonoesis, the feeling that one's awareness of particular past events is grounded in firsthand experience. Autonoesis guides us in sharing our experiences of past events, not by telling us when our credibility is at stake, but by telling us what others will find informative; it also supports the sense of an enduring self.

Human knowledge of past particular events is enabled not only by episodic memory, but also by semantic memory and by inference: for example, in detective work from currently perceivable evidence. With various ways of knowing past events, it is an interesting question why we have autonoesis, the self-reflexive consciousness that is applied to the past in episodic memory. Mahr & Csibra (M&C) propose that its function is communicative: We need to keep track of whether judgments about past events originate in firsthand experience in order to share these judgments most effectively with others. M&C may be right to connect consciousness and communication, but some details of their argument are debatable.

According to M&C, autonoesis is "the capacity that enables us to distinguish between cases in which we can assert epistemic authority for our own testimony and cases in which we cannot" (sect. 3.1.1, para. 4), where asserting epistemic authority is a matter of staking one's credibility on the truth of what one is asserting. However, one's credibility is at stake in any assertion, whether it is grounded in present or past firsthand experience, inference, or testimony. M&C are right that one may choose to assert that another person said something, endorsing only the fact that this person made a statement ("Jane said that Bill was fired"), but one may also assert the bare proposition learned through testimony ("Bill was fired"), taking a source's word for it and risking one's own reputation in spreading the gossip. One's reputation for reliability is at stake even if one explicitly marks the assertion with an evidential like "apparently" to indicate a testimonial basis, or an epistemic modal ("Bill must have been fired") to indicate inference; indeed, claims made with such markers are not inherently weaker than their directly grounded counterparts (Von Fintel & Gillies 2010).

Rather than seeing epistemic authority as something binary, either staked or not, one might see it as a matter of degree, with the greatest confidence vested in what we have seen for ourselves. However, this would leave it unclear just why autonoesis was needed alongside the simpler quantitative sensibilities that already regulate the reliability of our reports from semantic memory (Goldsmith et al. 2002). More qualitative ways of understanding epistemic authority are perhaps more promising. Perhaps autonoesis tells us which facts we know will be most informative for others to hear. Semantic memory encodes similar facts and regularities across a community: Indeed, the background beliefs in which one has greatest individual confidence are most likely to be shared already by others (Koriat 2008). By contrast, episodic memory provides a unique record of particular events not widely known to others, together with information on who else witnessed these events. Knowing whether others know about a past event may indeed be useful in arguments, but it could also be valuable to the species for more cooperative purposes in communication, just as the conscious availability of subjective confidence enables pooling of current perceptual judgments to increase accuracy in joint decision making (Bahrami et al. 2010).

Autonoesis can fail to accompany the capacity to retrieve events, although this is rare: Klein (2015a) reports finding only three such cases in the literature. One describes a recently amnesiac patient who was able, when questioned, to narrate many details of his older brother's death in an automobile accident roughly a year before. When complimented on his recall, the patient looked puzzled and insisted that it was the interviewer who had just told him about what had happened to his brother (Talland 1964). Despite his confusion between another's testimony and his own recall, the patient was not reported as lacking confidence in the facts surrounding the automobile accident: He expressed no uncertainty as to whether these were real or merely imagined events. If this patient had detailed knowledge of events in his personal past and the capacity to narrate these events to others, what was he missing? Talland notes that recall in this case was secured only by a series of prodding questions, rather than flowing spontaneously. Autonoesis enables recognition of what one's audience will not already know: The intuitive sense of private access to one's personal past enables recognition that description of these events will be informative to others; lacking that sense leaves one unmotivated to share one's knowledge.

M&C's qualitative characterization of the epistemic role of episodic memory focuses on argument: They define episodic memory as "an epistemic attitude taken toward the simulation of a specific past event, which serves to justify a belief about the occurrence of this event" (sect. 1.3, para. 1). However, one may take an epistemic attitude toward a simulation of a past event without remembering the event in question; for example, when visualizing how an animal might have freed itself from the broken trap one is looking at, or when reconstructing what one must have done in the course of last night's drunken stupor. Beliefs about past events may be well justified by imaginative simulation informed by current perceptual input, and these simulations can make us aware of why

https://doi.org/10.1017/S0140525X17000012 Published online by Cambridge University Press

we believe what we do, supporting argumentation without constituting moments of episodic memory.

M&C take the importance of having and enforcing human social commitments as a reason for the development of episodic memory. I agree that commitments and autonoesis are closely linked, but I wonder about the direction of explanation: It seems to me that in order to enter into a social commitment binding my future self, or to feel bound by my past commitments, I must already have the sort of sense of self, enduring in time, that is enabled by autonoesis. M&C would be on firmer ground if proto-humans with mere event memory could already make social commitments, where the emergence of autonoesis could then offer a way to strengthen and enforce those commitments. I wonder whether the power to make social commitments might not be just one of the many adaptive consequences of the human sense of self (Metzinger 2004), so that autonoesis would be better explained by its contribution to that larger construct, with its diverse adaptive advantages.

False memories, nonbelieved memories, and the unresolved primacy of communication

doi:10.1017/S0140525X17001455, e25

Robert A. Nash

Department of Psychology, Aston University, Birmingham B4 7ET, United Kingdom.

r.nash1@aston.ac.uk www.robert-nash.com

Abstract: Mahr & Csibra (M&C) make a compelling case for a communicative function of episodic remembering, but a less compelling case that this is its *primary* function. Questions arise on whether confirming their predictions would support their account sufficiently, on the communicative function of preserving rich, nonbelieved memories, and on the epistemic benefits of developing false memories via the acceptance of misinformation.

The target article contributes appreciably to the established literature exploring the social functions – among other functions – of accurate and inaccurate remembering (Bluck et al. 2005; Newman & Lindsay 2009). Mahr & Csibra (M&C) prompt us to rethink our conception of these social functions; specifically, they propose that remembering is adaptive primarily because communicating our memories can lead others to share our beliefs. The case for this communicative function is compelling, and M&C's account lays the ground for interesting new directions in empirical research, requiring novel methodological paradigms. But the case for the primacy of this function over other functions is currently unresolved.

What kinds of empirical evidence would strongly support or falsify the primacy of communication? M&C make some reasonable predictions, but support for these can arguably only bolster confidence in the existence of a communicative function, not provide evidence of its primacy. For instance, the authors predict that people should engage in more conservative, effortful source monitoring whenever a prospective listener is likely to be skeptical. This prediction seems complementary to the literature demonstrating "audience-tuning" effects on remembering (Echterhoff et al. 2008); more generally, there is broad agreement that metacognition is strategic, goal-driven (Johnson et al. 1993; Koriat & Goldsmith 1996b), and influenced by similar processes as is social persuasion (Blank 2009; Leding 2012; Nash et al. 2015). But does this broad agreement confirm that episodic remembering must primarily serve communication? Not at all. Indeed, although communicative goals undoubtedly can motivate source monitoring, these goals do not necessarily take precedence over other self-serving goals. When a skeptic challenges the authority of our memories, for example, we seem in fact to systematically prefer cheap-and-easy strategies, not reliable strategies, for verifying the truth (Nash et al. 2017; Wade et al. 2014).

Additional questions arise when we stay on the matter of people disputing their own memories. M&C emphasize that believing in an event's occurrence does not necessarily imply remembering the event; however, they omit to note that the converse is also true. That is, people frequently retain episodic memories of events that they no longer believe truly occurred (Clark et al. 2012; Mazzoni et al. 2010; Otgaar et al. 2013; Scoboria et al. 2017). Importantly, these so-called *nonbelieved memories* often retain the rich, autonoetic phenomenology that typifies believed memories. Our ability to preserve these memories could be adaptive, given that our reasons for disbelieving any particular memory may themselves transpire to be misguided (Scoboria et al. 2014). But the existence and characteristics of nonbelieved memories must nevertheless tell us that autonoesis is more than simply "a proposition to the effect of 'I had these experiences'" (M&C, sect. 1.1.2, para. 1), and that episodic remembering cannot, by necessity, be epistemically generative. M&C must account for the durability of autonoesis in cases where a remembered event is not believed to have occurred.

Although M&C do not discuss nonbelieved memories, they do give greater attention to the adaptiveness of false memories. Susceptibility to false memories might offer numerous specific benefits to the rememberer (Bernstein & Loftus 2009; Howe 2011; Nash et al. 2016), but M&C propose that this susceptibility is also generally adaptive, because convincing ourselves of self-serving beliefs is an essential first step toward convincing others. They further propose a reciprocal benefit: adopting other people's beliefs into our own recollections can be "communicatively useful" as a means of enhancing our epistemic authority. Both of these proposals warrant scrutiny.

First, is the adaptiveness of (false) remembering really contingent on whether or not we communicate our memories to others? Many examples of self-serving memories give cause for doubt: Remembering plays well-documented roles in identity formation and maintenance, for instance, and so establishing positive self-regard – even if based on false beliefs – can provide important benefits to well-being (Conway & Pleydell-Pearce 2000; Wilson & Ross 2003). Episodic remembering enables us to generate and preserve self-serving beliefs about our own past such as these and also to generate the same self-serving beliefs in other people. But it seems counterintuitive to imply that the adaptive benefit of having others share our self-serving beliefs must be greater than the adaptive benefit of us holding those beliefs ourselves.

Second, does altering our memories to accord with another person's memories really afford greater epistemic authority? Suppose that Doris and Jack observe a theft, and Doris later claims that the thief had red hair, whereas Jack cannot recall the thief's hair. M&C correctly note that people typically treat the richness and detail in others' memory reports as signals of epistemic authority (Bell & Loftus 1989); the authors therefore suggest that Jack could become an ostensibly more authoritative source by integrating detail from Doris's memory into his own. Yet M&C might have equally noted that people are persuaded by good calibration: We trust witnesses who realize what they remember poorly, as well as what they remember well (Tenney et al. 2007). In this sense, even patchy memories – not only detailed memories – can signal epistemic authority. This interpretation makes it more difficult to construe misinformation acceptance as necessarily adaptive: Jack could gain greater authority as a witness precisely *because* rather than accepting the misinformation, he maintains that he cannot remember the thief's hair. Moreover, the benefit of accepting misinformation is even less clear in cases where memories are altered, rather than supplemented. Suppose that Jack initially recalls that the thief's hair was brown, but nevertheless alters his recollection to accord with Doris's (red hair). Here, Jack's testimony neither becomes more detailed as a result of accepting the misinformation nor

https://doi.org/10.1017/S0140525X17000012 Published online by Cambridge University Press

necessarily becomes better calibrated. Once again, false remembering is unlikely to systematically enhance epistemic authority.

On the whole, M&C position their communicative account of remembering as a challenger to popular "mental time travel" accounts, raising astute questions that cast doubt on whether remembering evolved primarily to serve future planning. But before resolving, instead, that remembering evolved primarily to serve communication, M&C too have critical questions to answer.

Developmental roots of episodic memory

doi:10.1017/S0140525X17001467, e26

Katherine Nelson

CUNY Graduate Center (Distinguished Professor Emerita), New York, NY 10024.

knelson@gc.cuny.edu

Abstract: Two arguments imply that Mahr & Csibra's (M&C's) functional theory is insufficient as an explanation of episodic memory: (1) The developmental course supports a different social cultural division of episodic and semantic memory, and (2) the existence of long-term autobiographical memory is not explained in the functional theory but can be seen in a broader cultural framework.

Mahr & Csibra (M&C) conclude that episodic memory functions to justify claims about past events in collaborative cultural discourse. This implies the emergence of episodic memory from a more general "semantic" base. In contrast, the developmental account here assumes an initial experiential self-memory base and the emergence of semantic memory in contrast to self-conscious experiential memory. This account enables understanding the emergence of long-term autobiographical memory, unique to human life and critical to a theory of human memory in cultural context but not addressed by M&C.

M&C argue against the claim that the key feature of episodic memory is its orientation to and use in future planning. I concur; however, I assume that all long-term memory, in humans and other animals, is oriented to the future, in anticipation of an event's recurrence in whole or in part (Nelson 1993). Episodic memory is not unique in this characterization, although it is useful in future planning.

The developmental story views the emergence of different memory kinds from early experiential memory of infancy. Ample research now exists, revealing that infants as young as 9 months may remember details of an experienced scene for a month or more. Such "prelanguage memory" (in development or in evolution) is necessarily self-memory – memory as experienced by the self. Yet specific experiential memories of infancy and very early childhood – if they exist – are later "lost" in the sense of "childhood amnesia" – the inability of older children and adults to recall memories from the first three years of life. This initial lack contrasts with the ability of most people to recall some episodic memories from later years for many decades. As the latter ability is the essence of episodic memory, its emergence in childhood is an important clue to the episodic function issue addressed by M&C.

The proposal here is that memory (initially confined to self experience) divides in early childhood into episodic (self experiences) and semantic (memory from other sources). The episodic component develops the character of a definite self in experience and of a specific past, the two components identified by Tulving (1983b). The semantic component then carries general information, whether attained through personal or other source.

Objectively, all infant memory is *self-memory*, and by virtue of the fact that it is memory, it is about the past; but infants are not conscious of these characteristics. These components develop in childhood as both time concepts (seasons, days and time of day, years) and a self-concept are acquired and elaborated in cultural contexts. The claim here is that both episodic and semantic memory emerge from their source in infant memory as the child engages in social cultural communication through language. Substantial evidence supports the conclusion that children learn to elaborate their memories of experience through conversations about the past with parents and other adults (Nelson & Fivush 2004). In these and other exchanges the idea of a unique self, contrasted with the selves of others, becomes salient between 3 and 5 years.

The distinctive source of information, leading to the differentiation of *my* versus *other* knowledge develops during this same period (Nelson 2007). The child's introduction to culturally shared knowledge through language – stories, recounted events, general information sharing, videos, and other sources – serves as a catalyst for the eventual emergence of the two "memories": mine and others' or episodic and semantic, the latter preserving information conveyed by others as well as general knowledge of events.

One of the main claims of M&C is that a memory is not preserved as an episode, but is reconstructed in use. This claim is not conflict with the developmental story: In any case, the elements of the memory that are brought into consciousness must be accessible and realizable as belonging to a particular time and place.

Long-term autobiographical memory that most people in many cultures retain throughout life becomes more understandable in the developmental view where episodic memory has personal value. Episodic memory is focused on self-experience – the self is an important component giving meaning to the experience. These memories have the characteristic of all episodic memories, but they are selected from many briefly retained episodic experiences and constitute the makings of a kind of story of one's life (Nelson 2017). It is these memories, some from decades in the past, that people often report as being not simply recalled but "re-experienced." There is no generally accepted theory of their selection from among many that are lost over time, brief or extended.

This accumulation of episodic memories is a vital part of that system and demands explanation but is not accounted for by M&C. A general cultural communicative use of memory is sharing information among those in one's cultural group. With language (for the individual or in the group), what had been restricted to personal memory can be shared to everyone's advantage. Your episodic memory then becomes my semantic memory.

This much is in tune with the claims of M&C. But long-term episodic memory – autobiographical memory – seems to require further explanation. It brings the self as a person with a history into the cultural milieu, a contribution with the eventual possibility of its use in history, biography, group planning, poetry, novels, and more.

Enhanced action control as a prior function of episodic memory

doi:10.1017/S0140525X17001479, e27

Philipp Rau and George Botterill

Department of Philosophy, University of Sheffield, Sheffield S3 7QB, United Kingdom.

p.rau@sheffield.ac.uk
https://sheffield.academia.edu/rau
g.botterill@sheffield.ac.uk
http://www.sheffield.ac.uk/philosophy/staff/profiles/botterill

Abstract: Improved control of agency is likely to be a prior and more important function of episodic memory than the epistemic-communicative role pinpointed by Mahr & Csibra (M&C). Taking the memory trace upon which scenario construction is based to be a stored internal model produced in past perceptual processing promises to provide a better account of autonoetic character than metarepresentational embedding.

Mahr & Csibra (M&C) argue that the proper function of episodic memory is to support epistemic authority in communication.

https://doi.org/10.1017/S0140525X17000012 Published online by Cambridge University Press

Although this is really an evolutionary claim, they explicitly eschew historical evidence and instead present the claim as an inference from design features. This is an accepted strategy, although one that can misfire in "spandrel" cases, where some trait developed for another function or simply as a by-product becomes available for further purposes (Gould & Lewontin 1979). In this case, the M&C functional hypothesis has consequences that may well be considered surprising: that episodic memory has a relatively short evolutionary history and is exclusively human.

We are skeptical that a major cognitive capacity will have one single function. In general, there are likely to be many fitness-relevant functions for any cognitive adaptation. M&C are right to claim that episodic memory plays an epistemic role that is useful in social interaction. But it is not clear what pressing adaptive problem this function helps to solve. Contrast the M&C hypothesis with the proposal of a cheater detection module (Cosmides 1989; Cosmides & Tooby 1992). Those engaging in social contracts need to defend themselves against exploitation by free riders. But how do those engaging in communication benefit from such authority as episodic memory confers upon beliefs? If anything, hearers will have to exert *greater* vigilance to guard against the more cunning deceptions that can be supported by claims to have seen or heard something. Admittedly, speakers may communicate more confidently given the source knowledge incorporated in episodic memory. But such source knowledge is epistemically supportive in relation to the subject's own beliefs, *whether communicated or not*. Did I leave the house secure? Yes, I can remember how it looked and felt to turn the key in the lock, so I did. That sort of inference is surely adaptively valuable.

We think there is a strong case for holding that a prior function of episodic memory is the fact that autonoetic recall enables experience to improve an agent's control of his or her actions. One remembers seeing and hearing, which is different from remembering *that* one saw or heard, because the autonoetic character represents the perspective of a perceptual agent. One also remembers doing things and what that felt like, and how successful the action was. Could anyone become a skilled hunter without episodic memory? Although practice may improve proficiency in simple skills merely in terms of acquiring dexterity and strength (through procedural memory), improvement in any innovative technique requires experience to enhance future performance in a more flexible way, through episodic memory of previous attempts and their outcomes. Just as a driver (without satellite navigation) relies on episodic memory to retrace a once-traveled but unfamiliar route, our ancestors needed to remember the path through a forest, recalling dangers previously met and now to be avoided. The special salience given to memories by social emotions bears witness to the adaptive advantage episodic memory gives in social interaction: remembering occasions when one was shamed or embarrassed helps to avoid their recurrence.

What happens when an agent draws on episodic recollection, in the exercise of a complex skill, in the recall of a past event, or for that matter in the social-communicative situations that M&C highlight? We suggest that he or she has recourse to stored *internal models* (Petro & Muckli 2016; Wolpert et al. 1995; 1998) of previous actions, which represent the agent in his or her interactions with the environment *from the agent's point of view*. The stored internal model is the memory trace that is embellished by a process of scenario construction. Is combining a source tag with scenario construction and in addition embedding the content within metarepresentation (M&C's "distinctive epistemic attitude") sufficient to account for autonoesis? We think not. M&C are right that autonoesis is a generative source of knowledge about the personal past. But if that is so, then the metarepresentation of propositional content – which they seem to claim is the root of the autonoetic character of episodic recollection – is not the *origin of* but rather *derived from* that source. Autonoesis is built in from the start, rather than being added by metarepresentation. Thus, we are puzzled by the way M&C distinguish episodic from "event" memory, in that this seems no mere distinction between "actor" and "spectator" memory, but between remembering with and without autonoesis. Even spectating, however, involves a particular point of view that matches the autonoetic character of later recollection. As for actions involving a deliberate intervention in an organism's environment, these are made possible by an organism representing itself in relation to environmental features. It is no surprise, then, that autonoetic self-representation should also be part of later episodic recollections. This applies to one's remembering locking the front door; it may even apply to a scrub jay remembering caching food (Clayton & Dickinson 1998).

Given that the function of internal models is to fine-tune and successfully complete actions, it is more than plausible that reactivating a stored internal model will facilitate successful replication and provide a check on successful completion. Now that we realize the extent to which the brain is a predictive machine (Clark 2013; 2014), we should acknowledge that the nature and representational format of the internal model depends upon the two-way flow of perceptual processing. Thinking of the memory trace as merely stored information is a relic of the armchair take on perception, whether as passive imprinting or as bottom-up input computation. Given that the percipient is not just spectating, but also running, scrambling, and grappling, the internal models generated and corrected in perceptual experience operate to tune the agent for interaction with his or her environment. One consequence of this attunement is episodic memory, then available for replicating actions, as well as social-communicative purposes, which recycle a capacity already there. So, in our view, M&C's metarepresentational embedding of episodic content really relates to our ability to *report on* our autonoetic recollections.

Misconceptions about adaptive function

doi:10.1017/S0140525X17001480, e28

Jonathan Redshaw and Thomas Suddendorf

School of Psychology, University of Queensland, St Lucia, Brisbane, QLD 4072, Australia.

j.redshaw@uq.edu.au t.suddendorf@psy.uq.edu.au

Abstract: Mahr & Csibra (M&C) fail to make the important distinction between why a trait originally evolved, why it was maintained over time, and what its current utility is. Here we point out that episodic memory may have originally evolved as a by-product of a general metarepresentational capacity, and that it may have current functions beyond the communicative domain.

Mahr & Csibra (M&C) argue that episodic memory should be defined by its metarepresentational format, and that this format endows it with an additional communicative function over and above that provided by non-metarepresentational "event memory." Although we are sympathetic to the idea that metarepresentations may be centrally involved in episodic memory (cf. Redshaw 2014; Suddendorf 1999), and that the construction of nested mental scenarios and our urge to exchange them may be central to what distinguishes humans from other animals (Suddendorf 2013), we have concerns with M&C's characterization of adaptive function.

Although M&C state that they are not making claims about the actual evolutionary history of episodic memory, we do not see how a serious discussion of adaptive function can simply sidestep this central issue. In doing so, the authors fail to recognize the important distinction in evolutionary biology between (1) the forces that initially brought about a trait in the past and (2) the current utility or present-day fitness consequences of a trait. Whereas the former concerns adaptive function in the sense envisioned by Tinbergen (1963), the latter may also be considered adaptive function but is

https://doi.org/10.1017/S0140525X17000012 Published online by Cambridge University Press

hotly debated (e.g., see Bateson & Laland 2013; Nesse 2013). Furthermore, the authors' interpretation does not quite fit either of these evolutionary conceptions of function. Instead, they refer to the forces that have allowed a capacity to be "retained in the selection process" (sect. 2, para. 1). Retention is a separate issue from original function or current utility, and traits can remain within a gene pool as long as they are not detrimental to fitness (e.g., even if they no longer add adaptive value).

Tinbergen's (1963) original sense of adaptive function is probably the most widespread and perhaps the most challenging question to answer. Without a time machine, it is difficult to determine why any trait, let alone a cognitive trait that leaves no direct fossil record, originally evolved. Episodic memory may have evolved because it provided our ancestors with a direct survival and/or reproductive benefit, but it may just as well have evolved as a by-product of another capacity with benefits in other domains. For instance, although we agree that the capacity to form metarepresentations may have fundamentally transformed the nature of memory (e.g., Cheng et al. 2016; Redshaw 2014), we note that it may have also fundamentally transformed foresight (e.g., Redshaw & Suddendorf 2016; Suddendorf & Corballis 2007), communication (e.g., Suddendorf 2013; Wilson 2000), and the understanding of minds (e.g., Perner 1991; Stone & Gerrans 2006). Therefore, it is possible that episodic memory is a by-product of a metarepresentational capacity that initially evolved in another domain, even if it may have current utility.

Furthermore, when considering current utility (or trait retention), there is no reason to presuppose that episodic memory must have only one significant effect on fitness. Dextrous hands and opposable thumbs, for instance, may have originally evolved to allow primates to thrive in forest environments, but later on they allowed hominins to create tools for use in the savannah (and now they allow us to write and to engage in many other activities that may result in fitness benefits). Likewise, even if episodic memory has a communicative function, as M&C argue (and we agree that it has), it may also have many other current uses. For example, it enables people to learn from an event more than once and to draw lessons based on the discovery of connections between two or more events (Klein et al. 2009). And despite M&C's protestations, episodic memory may also have a future-oriented function.

One of us was involved in putting forward the case that episodic memory is but one instantiation of a general, mental time travel system that allows us to mentally construct scenarios situated in the past or future (Suddendorf & Corballis 1997; 2007, cf. Addis et al. 2007). Supporting this view, episodic memory and episodic foresight share close links in the brain (e.g., Schacter et al. 2007), in development (e.g., Busby & Suddendorf 2005), in phenomenology (e.g., D'Argembeau & Van der Linden 2004), and in their dysfunctions (e.g., Kwan et al. 2010; Race et al. 2011). And although episodic memory probably has (current) functions of its own, the principal benefits of this general system may lie in its open-endedness, which allows us to imagine various future alternatives and subsequently shape the future to our own design.

M&C argue that this constructive perspective leaves retention of past episodes as an accident and cannot explain why episodic memory is frequently reliable, but this an unfair characterization of the position. Episodic memory may well be an adaptive design feature of the capacity for foresight (Suddendorf & Busby 2003), but this does not mean it is an accident and its common veracity is a mystery. Roughly accurate mental representations of past episodes are required as an arsenal of experiences from which to extrapolate. Furthermore, to understand the present and predict how the future may unfold, it is often necessary to construct narratives that link events across time. Narratives are of course also critical to human communication – and language capacities may have co-evolved with mental time travel to allow the sharing of episodic information (Suddendorf et al. 2009). This process does not require that we represent previous experiences with perfect accuracy, but it does require some level of veracity. So we tend to store the gist of past events, and even though reconstructions of the same event often vary over time (e.g., Schmolck et al. 2000), we can draw on these roughly accurate representations to construct future alternatives and evaluate them. By comparing several options in terms of their likelihood and desirability, humans are in the position to actively pursue one path over another and to prepare for multiple contingencies (Redshaw & Suddendorf 2016). Thus, in contrast to M&C's proposal, episodic memory may have many current functions, and a principal one might well be to enable the creation of roughly accurate representations of potential future events that can drive prudent action.

Confabulation and epistemic authority

doi:10.1017/S0140525X17001492, e29

Sarah Robins

Psychology Department, University of Kansas, Lawrence, KS 66045.
skrobins@ku.edu **www.sarahkrobins.org**

Abstract: Mahr & Csibra (M&C) claim that episodic remembering's autonoetic character serves as an indicator of epistemic authority. This proposal is difficult to reconcile with the existence of confabulation errors – where participants fabricate memories of experiences that never happened to them. Making confabulation errors damages one's epistemic authority, but these false memories have an autonoetic character.

I remember seeing the Grand Canyon for the first time. What's the point of remembering what that experience was like, over and above simply remembering that I've seen it? According to Mahr & Csibra (M&C), the autonoetic character of episodic memory is a signal of one's epistemic authority about the experience. It indicates credibility, which can be conveyed to others by asserting "I remember."

M&C's proclaimed ability to account for the autonoetic character of episodic memory is exciting, and gives their account an advantage over "future-oriented mental time travel" (sect. 2.1) accounts. Future-oriented accounts are popular because of their ability to explain the persistence and pervasiveness of errors in episodic remembering. Despite their popularity, M&C rightly note that these accounts fail to make sense of episodic memory's first-person perspective. If M&C's communicative account is to supplant them, then they must offer their own explanation of memory errors. In this commentary I question whether M&C's account of errors is successful, focusing specifically on confabulation. Confabulation has an autonoetic character, yet damages one's epistemic authority.

Future-oriented accounts of episodic memory explain memory errors by downplaying or outright denying the importance of accuracy in the memory system. M&C's approach must be different. They view episodic memory as a source of epistemic authority; episodic memory must be (by and large) accurate in order to play this role. Still, they acknowledge that episodic errors are possible. M&C focus their discussion on the relationship between memory errors and a person's overall credibility. They begin by noting the bidirectional influence between episodic memory and belief. Sometimes an episodic memory forces a change in one's beliefs; other times beliefs alter a memory's content. The direction of influence is determined by the situational demands of epistemic credibility. They cite studies indicating that people alter their memories of a past event to be consistent with public reports when doing so maintains or improves their status as a witness. In other cases, where one's credibility depends on immunity to social influence, M&C note that participants often resist alterations. M&C also offer a prediction about when we should expect people to be at their most vigilant about misinformation: "If the costs of being found wrong are high, or our audience can monitor our assertions effectively, we ourselves should be more skeptical toward the outputs of our own construction system … and consequently be less likely to form a false memory" (sect. 3.1.3, para. 4).

https://doi.org/10.1017/S0140525X17000012 Published online by Cambridge University Press

To evaluate M&C's explanation, it helps to distinguish between different types of memory error. Elsewhere, I have argued for a distinction between *misremembering* and *confabulation* (Robins 2016a; 2017; see also Michaelian 2016b for an expanded alternative taxonomy). Misremembering is the distortion of retained information; confabulation is an entirely fabricated "memory." The errors M&C discuss are misremembering errors. They focus on cases where one swaps or adds details to the report of a past event. And it seems right that these edits, even when they result in less accurate memories, will have a minimal influence on a person's epistemic credibility overall.

Confabulation errors are different. M&C discuss Loftus's misinformation studies, which provide evidence of misremembering but do not mention other suggestibility studies by Loftus and colleagues, which show that participants can be led, somewhat easily, to confabulate past experiences. Loftus and Pickrell (1995), for example, found that many participants formed false memories of childhood experiences – events like spilling the punch at a family wedding or being lost in a shopping mall – in response to repeated interviews by researchers. Most importantly, these fabricated memories have an autonoetic character. These studies are intriguing, and disturbing, because participants report details of events that never happened, and do so from a first-person perspective.

The existence of confabulation errors is difficult to reconcile with M&C's communicative account of episodic memory. Feeling as if one remembers a confabulated event would seem to present a serious threat to one's epistemic authority. How is this tendency to generate false memories compatible with the view that the feeling of remembering is a signal of epistemic certainty?

M&C do not discuss confabulation errors. This oversight is likely due to their focus on memory's role in communication. As they note, "when we argue about the past, we often do not contest whether the event in question happened, but rather in what way it did" (sect. 3.1.1, para. 8). It is true that we do not often argue about the occurrence of past events, but this would only seem to make people's willingness to invent past events all the more troubling – and damning for the confabulator's epistemic credibility if discovered. At the very least, participants' willingness to endorse these false reports indicates a lack of the sort of epistemic vigilance M&C predict that people would display in such circumstances.

One might respond, on M&C's behalf, that the experimental situation entices participants to comply in order to appear credible. Perhaps. But it seems equally plausible to assume that participants would be on their best epistemic behavior while monitored by researchers. And even if participants feel compelled to comply, it would seem most prudent for them to accept the information without the first-person perspective, forming an event memory rather than an episodic one. By M&C's own lights, adding autonoetic character is optional, and it is mysterious why it should appear in these cases.

Confabulation has its limits. Few people can be led to "remember" being abducted by aliens, for instance (Clancy et al. 2002). But the repeated empirical demonstration that mundane confabulations are somewhat easy to induce is a threat to our epistemic authority over past events and to M&C's account of episodic memory formed on its basis.

What psychology and cognitive neuroscience know about the communicative function of memory

doi:10.1017/S0140525X1700156X, e30

David C. Rubin

Psychology and Neuroscience, Duke University, Durham, NC 27708.
david.rubin@duke.edu
http://psychandneuro.duke.edu/people/david-c-rubin

Abstract: Mahr & Csibra (M&C) include interesting ideas about the nature of memory from outside of the field of cognitive psychology and cognitive neuroscience. However, the target article's inaccurate claims about those fields limit its usefulness. I briefly review the most serious omissions and distortions of the literature by the target article, including its misrepresentation of event memory, and offer suggestions for forwarding the goal of understanding the communicative function of memory.

The first paragraph of Mahr & Csibra's (M&C's) target article claims that Tulving's semantic versus episodic distinction "has become virtually universally accepted." From its earliest introduction to the present, this distinction has been controversial and rejected by many researchers (e.g., Anderson & Ross 1980; McKoon & Ratcliff 1979) and most of the commentaries in Tulving's *Behavioral and Brain Science* (*BBS*) article (Tulving 1984). A more recent *BBS* article (Lane et al. 2015, p. 48) notes that "the dividing line between semantic and episodic memory is getting harder to see." For some of us, it is impossible (Rubin 2006). This distinction is a weak scientific basis for investigating why we remember; moreover, it is not needed.

In the target article, the main work of the semantic-episodic distinction is to justify the concept of autonoetic consciousness. Autonoetic consciousness was introduced after the basic episodic-semantic distinction (Tulving 1985) and can stand independent of the rest of the claims of that distinction. Similar concepts, such as recollection, have long been included in many theories of memory. Moreover, autonoetic consciousness need not depend on episodic processes. In older adults, compared to younger adults, the subjective sense of vividness of episodic memories that is a part of autonoetic consciousness can depend more on neural systems related to sematic category representations (Johnson et al. 2015).

The first paragraph of the target article also claims that memory research has been "preoccupied with studying the capabilities of human memory rather than aiming to illuminate its function." However, the functions considered in the target article are limited to a small subset of intellectual traditions. M&C do not cite serious, influential researchers as alternative approaches. These include Berntsen, Bluck, Boals, McAdams, Habermas, and Tomasello (e.g., Bluck et al. 2005; Boals & Klein 2005; Harris et al. 2014; McAdams 2006; 2013; Rasmussen & Berntsen 2009; Tomasello 1999; Tomasello et al. 2005). Studies of the theory of mind that address the functions of memory, including the communicative function, are also not mentioned. The goals of the target article would be better served by a broad examination of its key communicative function concept.

M&C wrongly claim in their abstract that, in considering "episodic memory functions," researchers have "focused on explaining its constructive character through its role in future-oriented mental time travel," a recent and relatively minor influence on the development of theories of constructive memory. The long history of theories of the constructive nature of memory is minimized (e.g., Bartlett 1932; Barsalou 1988; Brewer 1986; Neisser 1967; 1976; Neisser & Fivush 1994; for reviews, see Rubin 2006; 2014). The integration of these and similar theories could increase our understanding of the communicative function.

There is also a great deal known about the neural basis of memory and especially autobiographical memory that is relevant to the target article. These include papers that distinguish between laboratory-episodic and autobiographical memory studies that vary on communicative function in ways that would inform the key issues of the target article (e.g., Cabeza et al. 2004; Cabeza & St. Jacques 2007; McDermott et al. 2009; St. Jacques 2012). In summary, the target article omits major theoretical and empirical work on episodic memory, memory functions, the constructive nature of memory, and the neural basis of memory. Moreover, it does not fairly represent many areas it includes. I focus on one area related to my own work.

In section 1.1.3, on event memory and episodic memory, M&C review a collection of theories that share little beyond the use of the word "event." They note that different formulations of event memory are deficient in one, but not all, of the following: location in subjective time, conscious awareness, self-reference, source

https://doi.org/10.1017/S0140525X17000012 Published online by Cambridge University Press

information, and narrative structure. M&C put them all into an idea blender and make a homogenized, conceptual smoothie that retains nothing that could be of any theoretical use. There is a failure to note that one theory of event memory, which the target article cites (Rubin & Umanath 2015), aims to replace the role played by episodic memory with event memories, defined as memories including scenes, as the key scientifically based distinction. It keeps episodic memory as a special case, which has a whole host of other properties (Tulving 1984, p. 224, Table 1; Rubin & Umanath 2015, p. 3, Table 2), not all of which are related to the communicative function. Unlike the properties of event memory listed as contrasting to episodic memory in Table 1 of the target article, it claims event memories (i.e., memories with scenes) can be epistemically generative and autonoetic.

Amnesia and the loss of the ability to imagine a generic scene, such as a beach on a sunny day, co-occur when the neural damage is to the hippocampi (e.g., Hassabis et al. 2007b; Maguire & Mullally 2013; Tulving 1985) or earlier in the visual ventral stream (Greenberg et al. 2005; Rubin & Greenberg 1998). These neuropsychological studies are supported by functional magnetic resonance imaging (fMRI) activation studies (e.g., Epstein & Kanwisher 1998; Mullally & Maguire 2013). Therefore, scene construction has a much clearer neural basis than episodic memory and a clear and, until recently, unexpected role in amnesia. The mental construction of any scene must be done from a specific location and time, which introduces a self located in space and time. In terms of the theory of event memory, this self is a necessary, but need not be a sufficient, condition for a sense of reliving and for belief that depends on a recollected memory of a real or imagined event. Thus, the construction of real and imagined scenes is central to communicating autobiographical memories that are perceived as relived and accurate. Visual scenes may play a role in communicative function that is at least as important as aspects of memory the target article considers.

Morgan's canon is not evidence

doi:10.1017/S0140525X17001509, e31

Steven Samuel and Nicola Clayton

Department of Psychology, University of Cambridge, Cambridge CB2 3EB, United Kingdom.

ss2391@cam.ac.uk **nsc22@cam.ac.uk**

Abstract: Mahr & Csibra's (M&C's) account of the communicative function of episodic memory relies more heavily on the case *against* episodic memory in nonhumans than their description suggests. Although the communicative function of episodic memory may be accurate as it pertains to *human* behaviour, we question whether Morgan's canon is a suitable foundation on which to build theories of supposedly human-specific traits.

Mahr & Csibra's (M&C's) account rests in part on the literature on human cognition but *stands full weight* upon Morgan's canon – namely, that in nonhuman behaviour, it is to the simplest levels of explanation that we must first appeal. Our approach is not to argue that M&C's thesis is wrong. However, Morgan's canon does not permit a *rejection outright* of higher cognitive processes in other species, because it is not evidence. Therefore, the unfalsifiability of M&C's account correlates perfectly with the provability of the presence of episodic memory in non-linguistic species. The canon is at best a sort of subjective (and likely anthropocentric) Bayesian prior, with a theoretically tenuous default setting of zero. We briefly present the case against zero, and for reasons of space focus on only two species: scrub jays and rhesus monkeys.

M&C's definitions of episodic memory and autonoesis are intrinsically human-specific, so we adopt a broad, "traditional" definition of episodic memory as the integrated knowledge of what, where, and when (WWW) something occurred, coupled with a sense of recollection or re-experience (autonoesis) when accessing this information. M&C redefine autonoesis somewhat more specifically than this, as an outcome of the metarepresentation of a scenario under the "epistemic attitude of remembering" (sect. 1.1.2, para. 5). We thus briefly examine evidence for WWW memory and the metarepresentation of memory, the latter being as close as empirical research on nonhumans can presently get to the authors' own definition, and invite the readers to draw their own conclusion.

Our first point is that WWW memory has been observed in a number of species (for a review, see Cheke & Clayton 2010), but it is in scrub jays that it has been most thoroughly examined. Jays selectively recover cached food according to *when* they cache it (i.e., if too long a time has passed, the worms perish, but the peanuts are fine), *what* it is (worms are tastier than peanuts, given the choice), and *where* they bury it (Clayton & Dickinson 1998; 1999b). Moreover, they can flexibly adapt to recover food types they have not recently been fed to satiety on (Clayton & Dickinson 1999a), show flexible awareness of the rate at which different food types decline in freshness (Clayton et al. 2001) or improve as they "ripen" (de Kort et al. 2005), can update their information about cached foods even between caching and recovery (Clayton et al. 2003), show awareness of which individuals may have been watching them while they cached (Dally et al. 2006), and can dissociate the location of specific food from other, less preferred food in the same container (Clayton & Dickinson 1999b). Clayton and colleagues, mindful of the autonoetic component of episodic memory that only language users can realistically convey, termed this "episodic-like" memory (see also Clayton & Russell 2009). Overall, this pattern of results suggests that the jays form an integrated and cognitively rich WWW memory (de Kort et al. 2005). Moreover, this memory is grounded in the jay's own agentive experience. This need not be a trivial point – the ability to judge a signal as unreliable, even from a conspecific (e.g., Cheney & Seyfarth 1988), suggests there is theoretical utility in retaining some aspect of the self as the source of information.

Second, there is also by now a substantial body of evidence suggesting nonhumans can metarepresent their own memory – essentially "know what they remember." Rhesus monkeys are the species for which the greatest amount of evidence is available. For example, in delayed matching-to-sample tests, the subject is presented with a stimulus to remember and then given a multiple-choice memory task after an intervening delay. The subject is either forced to take the test or given the opportunity to opt out before doing so. Rhesus monkeys showed evidence of greater accuracy on memory tests they chose to take than on memory tests that were forced (Hampton 2001) and were more likely to "bet" more on tests they were about to answer correctly or felt they already answered correctly (Morgan et al. 2014), suggesting that they could assess their own memories, even in the absence of the stimuli, and chose to take tests when their confidence was relatively high. In another task, rhesus monkeys were presented with a number of tubes and either witnessed one of them being baited with food or had no knowledge of which tube the food was in. The monkeys were more likely to look into the tubes first when they had no memory of where the food was than when they had seen the baiting, indicating that they "knew when they didn't know" (Basile et al. 2015; Templer & Hampton 2012; see also Hampton & Hampstead 2006). Moreover, these apparently metacognitive judgments have been shown to transfer across different tasks, lending weight to the argument that they are cognitively independent of associative learning and stimulus – or task-specific factors (Kornell et al. 2007; Morgan et al. 2014).

Crucially, we do not claim that nonhuman animals *must* have episodic memory or metamemory (Hampton 2009), and we believe that M&C's central argument may be correct, particularly as it pertains to humans, and may furthermore be testable. For example, in English we can make the distinction between the

https://doi.org/10.1017/S0140525X17000012 Published online by Cambridge University Press

episodic past (e.g., "I remember posting the letter") versus non-episodic past (e.g., "I remembered to post the letter"). One possible test of M&C's account could involve asking which sentence was more "ill-willed" when the participant knew the speaker was lying. Insofar as we may tie our reputations to the mast of our epistemic authority, we suspect the majority would be particularly irked by the invocation of specifically episodic rather than semantic memory in "I remember posting … ." However, the validity of the human story rests on the invalidity of the nonhuman one. Whether we should begin to look in more detail at the crux of M&C's profoundly *human* account of episodic memory, we leave to the reader to decide.

Constructive episodic simulation, flexible recombination, and memory errors

doi:10.1017/S0140525X17001510, e32

Daniel L. Schacter,[a] Alexis C. Carpenter,[a] Aleea Devitt,[a] Reece P. Roberts,[b] and Donna Rose Addis[b]

[a]*Department of Psychology, Harvard University, Cambridge, MA 02138;* [b]*School of Psychology and Centre for Brain Research, University of Auckland, Auckland, New Zealand.*

dls@wjh.harvard.edu

alexiscarpenter@g.harvard.edu **aleea_devitt@fas.harvard.edu**

r.roberts@auckland.ac.nz **d.addis@auckland.ac.nz**

http://scholar.harvard.edu/schacterlab/home

http://www.memorylab.org

Abstract: According to Mahr & Csibra (M&C), the view that the constructive nature of episodic memory is related to its role in simulating future events has difficulty explaining why memory is often accurate. We hold this view, but disagree with their conclusion. Here we consider ideas and evidence regarding flexible recombination processes in episodic retrieval that accommodate both accuracy and distortion.

Mahr & Csibra (M&C) bring together considerable evidence and ideas to advance their primary thesis that an important function of episodic memory is to support communicative interactions. We find merit in this discussion, but focus on a different aspect of M&C's target article.

M&C highlight what they believe is a problem with theories that hold that the constructive nature of episodic memory, and associated vulnerability to errors and distortions, is related to the role of episodic memory in constructing simulations of future events: The fact that episodic memory is often veridical "becomes mysterious in this view" (sect. 2.1.1, para. 2). M&C cite Schacter and Addis (2007) as proponents of this view, and others have advanced similar ideas (cf. Dudai & Carruthers 2005; Suddendorf & Corballis 2007). In what follows, we focus on our own perspective, the constructive episodic simulation hypothesis (Schacter & Addis 2007). We disagree with M&C's assertion that in our view, it is mysterious that episodic memory can be veridical.

According to the constructive episodic simulation hypothesis, remembering past experiences and simulating future experiences rely on similar kinds of episodic information and processes, including *relational processing* (e.g., Eichenbaum & Cohen 2014): the capacity to bind together distinct elements of experiences (for additional discussion, see Roberts et al. 2017). Our perspective further maintains that simulating future events requires a system that supports *flexible recombination* of details from past events into novel scenarios, which entails relational processing. Thus, episodic memory possesses key characteristics that make it adaptive for simulating alternative future scenarios and "trying out" novel approaches to those scenarios based on past experiences. However, the flexible recombination processes that are critical for episodic simulation can also make the system prone to errors that arise from mistakenly combining elements of stored episodes. Such memory conjunction errors (Reinitz et al. 1992) and related source misattributions (Johnson et al. 1993) are common forms of memory distortion (Devitt & Schacter 2016; Schacter 2001).

Critically, our emphasis on the perils of flexible recombination need not mean that the veridicality of episodic memory is mysterious. From our perspective, episodic memory is often accurate because constructing useful simulations of future experiences that benefit from what actually happened in relevant past experiences requires some degree of accurate representation; a memory system entirely lacking the capacity for accurate representation would be virtually useless for simulating the future based on the past. We already know from work on affective forecasting errors that limitations on episodic memory can produce inaccurate simulations of future happiness (Gilbert & Wilson 2007), highlighting that some degree of veridicality in episodic memory is critical for constructing accurate simulations of future experiences (see also, Schacter 2012). M&C (sect. 2.1.2) acknowledge that memory veridicality is important for future simulation, but seek to attribute this feature to semantic memory. We agree that semantic memory is critical for future thinking and may contribute to its accuracy, but we have shown in several studies that episodic memory makes distinct contributions to future imagining that are experimentally dissociable from semantic memory (Schacter & Madore 2016). Moreover, future thinking that relies solely on semantic memory (e.g., established schemas) would lack the flexibility that we think characterizes episodic memory and is crucial for future simulation.

In Schacter and Addis (2007), we addressed the issue of memory veridicality, emphasizing that although "a memory system that simply stored rote records of what happened in the past would not be well suited to simulating future events," the system we envisaged "can draw on elements of the past and retain the general sense or gist of what has happened" (p. 778). Remembering gist information may partly reflect the influence of semantic memory, but the key point is that we rejected the notion of an episodic memory that draws on "rote records" and did not reject the broader idea that episodic memory is to some extent veridical.

It should therefore be clear that from our view, the link between memory errors and constructing novel event simulations based on elements of past experiences depends specifically on the involvement of flexible recombination processes in episodic simulation, not on a wholesale dismissal of veridicality in episodic memory. Although in Schacter and Addis (2007) we cited no experimental evidence for a link between flexible recombination and memory errors, we have recently produced such evidence. Devitt et al. (2016) used an *experimental recombination paradigm*, where people, places, and objects that occurred together in actual past experiences are recombined into novel arrangements by an experimenter, and participants are then asked to imagine events involving the recombined details. Devitt et al. (2016) reported that such recombinatory processing sometimes resulted in autobiographical memory conjunction errors, where participants claimed that a novel, recombined event actually happened in the past. Carpenter and Schacter (2017) adapted an associative inference paradigm (Zeithamova & Preston 2010) that requires combining information from separate episodes involving people, objects, and contextual settings to make inferences about individuals who are linked to one another because each is paired with the same object. Across four experiments, Carpenter and Schacter (2017) showed that participants are more susceptible to false memories that result from mistakenly combining contextual details from related episodes when they make correct compared with incorrect inferences about the relations between the people in these episodes. Critically, this boost in false memories occurred only when contextual details were probed after (versus before) an associative inference test that engaged flexible recombination processes.

These findings highlight that flexible recombination – not mental time travel into the future per se – likely underpins the

https://doi.org/10.1017/S0140525X17000012 Published online by Cambridge University Press

link between episodic simulation and subsequent memory errors. Episodic future simulations rely on flexible recombination, but so do simulations of present and past events (Addis et al. 2009; Schacter et al. 2012; 2015). Future simulation is perhaps the main adaptive function served by flexible recombination processes, but is not the only one (Schacter et al. 2015). A memory system that supports episodic simulation requires some veridicality to benefit from past experiences, but reliance on flexible recombination to construct simulations can undermine memory accuracy when elements of experiences are mistakenly combined.

ACKNOWLEDGMENTS

Preparation of this article was supported by a National Institute of Mental Health grant MH060941 to DLS, a Faculty Research Development Fund grant from The University of Auckland to RPR, and a Rutherford Discovery Fellowship (RDF-10-UOA-024) from the Royal Society of New Zealand to DRA.

Beyond communication: Episodic memory is key to the self in time

doi:10.1017/S0140525X17001522, e33

Karl K. Szpunar[a] and Jason C. K. Chan[b]

[a]*Department of Psychology, University of Illinois at Chicago, Chicago, IL 60607;* [b]*Department of Psychology, Iowa State University, Ames, IA 50014.*

szpunar@uic.edu http://www.uicmemorylab.com

ckchan@iastate.edu http://www.jasonckchan.com

Abstract: Mahr & Csibra (M&C) propose that episodic memory evolved to support epistemic authority in social communication. We argue for a more parsimonious interpretation whereby episodic memory subserves a broader preparatory function for both social and non-social behavior. We conclude by highlighting that functional accounts of episodic memory may need to consider the complex interrelations between self and subjective time.

Since the publication of Tulving's (1983b) treatise on episodic memory, psychologists and cognitive neuroscientists have amassed an impressive amount of data elucidating the cognitive and neural mechanisms that give rise to and support first-person accounts of the experienced past (for reviews, see Dickerson & Eichenbaum 2010; Szpunar & McDermott 2008b; Tulving 2002a). Nonetheless, relatively little is known about *why* healthy human adults possess this capacity. Mahr & Csibra (M&C) propose that the defining component of episodic memory – the capacity to mentally re-experience the self in subjective time or autonoetic consciousness – may have evolved to support the negotiation of epistemic authority in social communication. According to this account, episodic memory enables people to ascribe confidence in their reporting of the personal past when interacting with others.

Although episodic memory undoubtedly serves to fine-tune the nature and quality of human interactions, we suggest that social communication represents but one instance wherein this capacity bestows an advantage for its owner. The crux of our argument is that many non-social circumstances also require an accurate and confident recounting of specific past experiences as a means for supporting adaptive behavior. As one example, consider the behavior of an individual who decides to walk home along the longer of two paths on the basis of a recent negative experience along the shorter path. In this case, the debate (deciding between the longer, safer route vs. the more convenient, but riskier route) takes place within the individual's mind, and mentally re-experiencing a pertinent past episode may help justify the most appropriate course of action. Because it is difficult to ascertain the circumstances of our evolutionary history under which recollections first emerged to guide behavior, a comprehensive functional account of episodic memory should be able to explain why salient past experiences tend to guide behavior in both social and non-social domains. In formulating his theory of episodic memory, Tulving (1985, pp. 9–10) seemingly envisioned such an account, stating that "the adaptive value of episodic memory and autonoetic consciousness lies in the heightened subjective certainty with which organisms endowed with such memory and consciousness believe, and are willing to act upon, information retrieved from memory … lead[ing] to more decisive action in the present and more effective planning for the future."

Beyond providing a sense of added certainty in guiding behavior, episodic memory may also play a pivotal role in conceptualizing the self's existence across time. Current events often cue spontaneous retrieval of past events, and these recursive reminding (Hintzman 2004) help bridge the recollected past with the anticipated future. Profoundly amnesic patients with episodic memory deficits that preclude recollection of much or all of the personal past and simulation of the personal future provide a window into the nature of this relation. Indeed, a striking deficit for patients with a dysfunctional episodic memory is that they are often "lost in time." For example, about 40 years after a medial-temporal lobe resection to alleviate chronic seizures, patient HM mistakenly believed that he had memory problems for only about one year (Corkin 2013). Similarly, following a motorcycle accident that resulted in diffuse brain damage, patient KC was unable to answer the simple question "how old are you?" even though he knew the date of his birth, because he did not know the current year in which he lived (Rosenbaum et al. 2005).

Of course, the aforementioned observations of amnesic patients are selective and are not intended to imply that amnesic patients lack a self-concept or the ability to think about time. Indeed, semantic knowledge may be sufficient to support cognitions about the self (Klein & Gangi 2010). Moreover, M&C highlight that K.C. showed delayed discounting (Kwan et al. 2012), suggesting that episodic memory is not necessary for some future-oriented aspects of cognition. Although people may be able imagine the future in a manner that does not involve episodic memory (Szpunar et al. 2014), this should not eliminate the possibility that episodic memory is necessary for future thinking that requires extending the self in time. We believe that two pieces of evidence support our argument. First, given that nonhuman animals such as pigeons and rats can discount future outcomes (Vanderveldt et al. 2016), it is unlikely that episodic memory is necessary for judgments of intertemporal choice. Second, whereas healthy human adults use event simulations to curb their tendency to discount future outcomes (Benoit et al. 2011; Peters & Büchel 2010), amnesic patients do not (Palombo et al. 2015). For instance, even though Kwan et al. (2015) found that some amnesic patients could use personally relevant future scenarios to support farsighted decisions, their amnesic patients experienced great difficulty generating relevant future scenarios and were aided by either personal calendars or relatives. Hence, in the absence of external support, an impaired episodic memory system is associated with an impoverished perspective of the self across time.

Finally, whereas we and M&C have focused primarily on the adaptive value of the autonoetic component of episodic memory, that is, mentally re-experiencing the self in subjective time, Tulving (2002b) further mused about the capacity to be aware of the subjective time in which the self exists. The distinction is subtle but may be important for understanding the evolution of episodic memory and of the human race as a whole. In theorizing about its functions, Tulving noted that the awareness of subjective time is integral to the ability of humans to establish a continued culture by which the world is altered to suit their needs, rather than adapting to the world. If humans did not possess the capacity to project their minds into the future, they would have no reason to alter their behavior, based on relevant past experiences or otherwise, to suit the future that is yet to exist (Tulving & Szpunar 2012; see also Klein 2013c).

https://doi.org/10.1017/S0140525X17000012 Published online by Cambridge University Press

Doing without metarepresentation: Scenario construction explains the epistemic generativity and privileged status of episodic memory

doi:10.1017/S0140525X17001534, e34

Markus Werning[a] and Sen Cheng[b]

[a]*Department of Philosophy, Ruhr University Bochum, 44780 Bochum, Germany;* [b]*Institute for Neural Computation, Ruhr University Bochum, 44780 Bochum, Germany.*

markus.werning@rub.de **http://www.rub.de/phil-lang/**
sen.cheng@rub.de
https://www.ini.rub.de/research/groups/computational_neuroscience/

Abstract: Episodic memories are distinct from semantic memories in that they are epistemically generative and privileged. Whereas Mahr & Csibra (M&C) develop a metarepresentational account of epistemic vigilance, we propose an explanation that builds on our notion of scenario construction: The way an event of the past is presented in episodic memory recall explains the epistemic generativity and privilegedness of episodic memory.

A characteristic feature of episodic memories, as pointed out by Mahr & Csibra (M&C), is that they are epistemically generative, rather than epistemically preservative: An episodic memory may generate extra epistemic justification for beliefs without being a belief itself. In this respect, episodic memories are analogous to perceptions, which are not beliefs either, even though their contents often ground beliefs, but sometimes also conflict with what is believed (e.g., in known perceptual illusions). Semantic memories (including non-episodic memories of particular events), in contrast, consist of beliefs that merely preserve their justificatory status within the belief system. When a 46-year-old asks himself what happened during the fall of the Berlin Wall almost three decades ago, a justification for him to form the belief that people were dancing on the wall may derive from a mnemonic simulation of that scenario. This simulation may draw on sensory as well as agentive and emotional information from episodic memory traces that were grounded in some of his experiences at the wall on November 9, 1989 (Cheng et al. 2016). A 20-year-old may also be justified to believe that people were dancing, but on the basis of recalling what she learned about the fall of the wall from other people or media. In her case, no new belief is formed, no extra justification gained. Another, closely related feature in need of explanation is why episodic memories have an epistemic status privileged over other sources of knowledge (although not infallible).

To account for the epistemic generativity of episodic memory, M&C postulate that subjects maintain a certain metarepresentational attitude toward the contents of their episodic memories – self-directed epistemic vigilance involving source monitoring. Through such a metarepresentational attitude, they hold, subjects are justified that the event information was obtained firsthand, that is, through their own experience. This "autonoetic" aspect privileges episodic memories over other sources of knowledge. Building on our notion of scenario construction as mnemonic simulation (Cheng & Werning 2016; Cheng et al. 2016), we propose an alternative view: It is the way an event of the past is presented in episodic memory recall rather than a metarepresentational attitude of the subject that explains the epistemic generativity and privileged status of episodic memory and distinguishes it from semantic memory.

To M&C one may object that, even though semantic memory (e.g., "it takes me 40 minutes to drive to work") fails to be epistemically generative, one may still assume a metarepresentational attitude toward its content. A subject may, for example, have the (justified) belief that the memory content is based on repeated experiences ("my commute has always taken me 40 minutes"). The subject may well represent a memory's source even though the memory is non-episodic. As a matter of intersubjective epistemic vigilance, the subject may even be able to recur to this source information when asked for a justification in communication. The capacity to assume a metarepresentational attitude toward a memory's content as a means of epistemic vigilance is thus not distinctive for episodic memory and, hence, not sufficient to explain its epistemic generativity and privileged status.

Moreover, if epistemic vigilance was the crucial function of autonoetic consciousness in episodic memory, as M&C postulate, then we would expect that there would have been an evolutionary pressure for humans to develop a measure for gauging the accuracy of their episodic memories. That is, the rememberer should be more confident of the content of her belief for those memories that are likely accurate than for those that are not, because epistemic vigilance is essential in social communication, and the confidence of the rememberer is an important source of information for the recipient to gauge the accuracy of socially communicated beliefs derived from episodic memories. We would, therefore, expect the self-assessed confidence in our own episodic memories to be strongly predictive of the accuracy of our memories. However, there is ample empirical evidence that contradicts this prediction. A number of studies suggest that even for highly memorable events, so-called flashbulb memories, the self-assessed confidence in a memory either has no, or only a very weak, correlation with its accuracy (Neisser & Harsch 1992; Talarico & Rubin 2003).

Let us now briefly sketch an alternative explanation. According to our view, in episodic memory recall a scenario of the event in question is mentally constructed such that the following holds:

(1) Information contained in episodic memory traces is combined with semantic information – prototypical features are filled in and need not be stored.

(2) Memory traces contain only physical "gist" information and are not conceptual mental representations themselves. They are, in particular, not compositional (Werning 2005) or systematic (McLaughlin 2009). A compositional representation is generated only during recall (Cheng & Werning 2013).

(3) Memory traces constitute a reliable causal link between experience and recall (Cheng & Werning 2016; Werning & Cheng 2017).

(4) The resulting scenarios are typically perspectival – which means more than just exhibiting a sensory viewpoint: they also involve an action direction and emotional stance (Russell & Hanna 2012).

(5) Scenarios are often vivid and in various respects resemble (but also differ from) the contents of perceptions.

First, from (2) it immediately follows that episodic memory traces are not beliefs because beliefs are conceptual mental representations. Only after recall is a hitherto non-existing belief formed. Second, the constructed scenario may serve as the source of epistemic justification. This is because, presupposing (3), scenario construction is – in a statistical sense – an epistemically reliable process (Goldman 1986). Episodic memory is hence epistemically generative. The fact that the constructed scenario is (typically) perspectival – following (4) – and in its vividness (often) resembles the contents of perceptions – following (5) – makes it finally likely that the presented event was experienced firsthand. This is a probabilistic relation, and the typical phenomenology of scenarios just serves as an indicator for its authenticity. This does not preclude that semantic memories may also in certain cases possess a perspective and some vividness. The epistemic privilegedness of episodic memory – as well as its epistemic generativity – is thus more a matter of statistics than of principle.

https://doi.org/10.1017/S0140525X17000012 Published online by Cambridge University Press

Authors' Response

What is it to remember?

doi:10.1017/S0140525X17001959, e35

Johannes B. Mahr and Gergely Csibra

Department of Cognitive Science, Cognitive Development Center, Central European University, 1051 Budapest, Hungary.

mahr_johannes@phd.ceu.edu csibrag@ceu.edu

https://cognitivescience.ceu.edu/people/johannes-mahr

https://cognitivescience.ceu.edu/people/gergely-csibra

Abstract: In response to the commentaries, we clarify and defend our characterization of both the nature and function of episodic memory. Regarding the nature of episodic memory, we extend the distinction between event and episodic memory and discuss the relational role of episodic memory. We also address arguments against our characterization of autonoesis and argue that, while self-referential, it needs to be distinguished from an agentive notion of self. Regarding the function of episodic memory, we review arguments about the relation between future mental time travel and memory veridicality; clarify the relation between autonoesis, veridicality, and confidence; and finally discuss the role of episodic memory in diachronic commitments.

R1. Introduction

We are grateful to all commentators for the stimulating and informative comments, which allowed us to clarify and extend certain aspects of our account and to understand our theory better through the lens of the criticism they provided. Unfortunately, even though the commentaries raised many valid points, we could address most of them only cursorily.

Let us mention at the outset a few issues that appeared recurrently in the commentaries: First, the target article offered arguments for a novel functional view of episodic memory. Such an article can necessarily only address some aspects of episodic memory, and we focused on what we perceived to be the crucial ones. We thus did not aim to review the entire literature relevant to episodic memory. Some commentators have accused us of not having mentioned certain proposals and evidence found in the literature on episodic memory (**Berntsen; Hirst & Echterhoff; Rubin**). We did so intentionally in order to not deviate from the arguments we intended to make.

Second, to make a functionalist claim, one has to first determine what the target phenomenon consists of. For this reason, we dedicated a considerable part of the article to specifying the design features of episodic memory. This allowed us to reason backward from the features we identified to the types of adaptive challenges that a mental capacity exhibiting said features would be best suited to solve. Doing so also allowed us to provide a precise characterization of our *explanandum*, made necessary by the lack of consensus in the literature about the properties that the target phenomenon should exhibit.

Thus, when debating our functionalist account, one may pursue one of three possible strategies: (a) argue that our assessment of the nature of episodic memory is inaccurate and thus does not fulfill the functions we propose, (b) agree with our characterization of episodic memory but argue that our functionalist argument does not follow from it (e.g., because there are more plausible alternatives or because it would require a different representational wherewithal), or (c) argue that both our assessments of the nature *and* function of episodic memory are misguided. Unfortunately, while the large majority of commentaries took issue with at least part of our functional claims, it was usually not made explicit what interpretation of "episodic memory" they were referring to. As a consequence, several comments that at first glance seemed to be following strategy (b) (i.e., debating our claims about the function of episodic memory) turned out to be instances of (a) (i.e., employing a different understanding of the nature of episodic memory) or (c) (i.e., proposing an entirely alternative account of the nature and function of episodic memory).

Following these points, we can sort the commentaries according to whether they target our account of the nature of episodic memory or our account of its function. We will first address commentaries relevant to our account of the nature of episodic memory (sect. R2) before addressing criticisms and suggestions pertaining to its function (sect. R3).

R2. The nature of episodic memory

In the target article, we defended the view that episodic memory should be taken to consist of (1) a (re-)constructed event simulation based on memory traces on the one hand and semantic information on the other and (2) a metarepresentational attitude (remembering) taken toward this simulation, resulting in its source being represented as firsthand (perceptual) informational access. We noted that a change in the attitude taken toward the simulation in question should result in different kinds of representations, one of which could be a (non-metarepresentational) believed event simulation (an intuitive belief about the past; see Sperber 1997), which we called *event memory*. Furthermore, we aimed to explain a range of memory errors by appealing to the fact the episodic construction process is not encapsulated from higher-level beliefs. That is, often we remember something because we believe it happened and not the other way around.

R2.1. Episodic construction processes

First, **Aronowitz** challenged us to account for the fact that recall in episodic memory is highly temporally ordered. Indeed, she is correct that this seems to be a feature that should be taken into account for any mechanistic explanation of episodic memory. She is also correct in pointing out that this phenomenon is not explained by our proposal. Nonetheless, while we agree that a mechanistic account of episodic memory should be able to account for temporally ordered retrieval, we do not perceive said property to stand in contradiction to our functional account. Moreover, it is not clear how competing alternative accounts of the function of episodic memory would make sense of this phenomenon.

Second, **De Brigard & Gessell** argued that our functional claims are contradicted by the findings that episodic amnesiacs like HM can engage in the appropriate type of reason-giving communication. On our analysis, however, while HM likely lacked the capacity to generate episodic content, the cognitive machinery necessary to represent

https://doi.org/10.1017/S0140525X17000012 Published online by Cambridge University Press

certain contents under the appropriate attitude ("as experienced") might have well been intact. This is supported by the observation that HM could make use of information represented in working memory precisely in such a way. As we have argued in the target article, episodic memory does not consist merely of a certain type of content. Rather, episodic content has to be represented in a specific way (i.e., as the outcome of firsthand experience). The cognitive systems responsible for generating episodic content, on one hand, and the embedding of such content under the appropriate attitude, on the other, should therefore be dissociable. While H.M. represents a dissociation in one direction (lack of episodic content construction with intact metarepresentational capacities), Klein & Nichols (2012) reported a complementary dissociation case: Patient RB was apparently able to generate episodic content but unable to embed this content under the appropriate attitude.[1]

Third, one strand of commentaries remarked on issues relevant to the construction process underlying the contents of episodic memory. **Keven**, in particular, took issue with the claim that the contents of event memory and episodic memory represent the outcome of the same construction process. He pointed out that the contents of these two types of memory should differ significantly because they follow different organizational principles. While event memory, on his view, includes only spatial organization, episodic memory is additionally organized according to temporal, causal, and teleological principles. For this reason, episodic memory acquires narrative character because it becomes possible to relate different events in a causal and teleological structure. We welcome these suggestions. It does seem plausible that causal and teleological relations within and across event representations would require additional inferential processes that are not produced by event construction but rather specify relations between them. Episodic memory constructions that are induced by the need to justify one's assertions in communicative exchanges do indeed call for the creation of rich event representations that go beyond spatial and temporal elements.

In fact, as **Kampis, Keszei, & Király** pointed out, this is likely true for processes at both the encoding and retrieval stages of memory formation. As they rightly mentioned, information will often have to be encoded and retrieved in relation to a given social partner, taking into account common experience and the ensuing common ground. Similarly, "destination memory," as mentioned by **El Haj & Miller** is thus likely the outcome of such additional inferential processes guiding encoding and enriching reconstructed content with causal relations relevant to communicative interaction. These processes likewise serve to maintain and track common ground in communicative interaction. We further agree with **Diekelmann, Paulus, & Krach** that consolidation processes during sleep have an important role to play in the mechanisms mediating between encoding and retrieval of episodic memories.

R2.2. Episodic memory and the maintenance of common ground

Nagel proposed that autonoesis, rather than serving as a signal of epistemic authority, tracks the informativeness of a given event representation for one's interlocutors. However, if episodic encoding and retrieval processes include elements of tracking and maintaining common ground, information about informativeness would come for free. Informativeness would thus not be a design feature of the metarepresentational component of episodic memory but rather fall out of the way its contents are generated. Moreover, **Nagel**'s view would not provide any explanation for the privileged role that humans assign to firsthand information. As **Henry & Craver** pointed out, one significant benefit of our account is that it makes intelligible why firsthand information is so often and intuitively treated as epistemically privileged. If autonoesis merely provided information about what would be informative, it could not account for the privileged treatment that autonoetic information receives in communication. In sum, although the co-occurrence of autonoesis and informativeness follows from our characterization of episodic memory, we do not think that one can be derived from the other.

Further, viewing episodic memory as playing a role in the management of common ground might throw light on why the creation of a "shared reality" is crucial in the maintenance of social relations, as emphasized by **Coman** and **Hirst & Echterhoff.** The reason why we care about maintaining common ground about the past with those close to us is because of (1) the role that such events play in maintaining cooperative relations in general and (2) the enormous inferential potential that specific episodes might have for learning about others' dispositions. Communicating about past events grounds gossip, determines individual accountabilities, and enables the transmission of inductively derived conclusions. In fact, joint reminiscing and sharing past experiences might do on the group level what private remembering does for the individual: create a collective sense of epistemic authority (Seeman 2016).

As emphasized by **Dessalles**, the unexpectedness of a given event should be an important factor governing both its tellability and memorability. This is to be expected under the assumption that sharing episodes is crucial for maintaining common ground with relevant interlocutors. However, the negotiation of communicative commitments via epistemic authority provides the backdrop through which episodic memory can fill this role. It matters whether the event one is told about is coming from one's interlocutor's personal experience, is made up, or is being retold in order to decide how much one should rely on it, how to transmit it further, and who is accountable for its truth. Of course, as **Fivush** pointed out, these practices of sharing memories have to be considered in relation to the given sociocultural context in which the speaker's identity might additionally determine how claims are evaluated. This, however, does not mean that claims to epistemic authority as such are entirely dependent on cultural context.

In spite of the clear applications of (the sharing of) episodic memories in the creation of common ground, we nonetheless view this role of episodic memory as secondary to its function as we analyzed it. Common ground can be tracked, maintained, and generated through semantic information alone. Of course, as described above, past events might carry implications, which make it particularly important to maintain common ground about them. In sharing those events (as experiences), episodic memory serves its primary function.

https://doi.org/10.1017/S0140525X17000012 Published online by Cambridge University Press

R2.3. Autonoesis and metarepresentation

The second, and in some sense central, aspect of our characterization of episodic memory has been our analysis of autonoesis. On our understanding, autonoesis is the outcome of a metarepresentational attitude taken toward the outputs of episodic construction processes. Consequently, we represent the fact that information about the event in question was acquired through firsthand experience. Thus, the intensional direction of the representational content of the memory points no longer toward the event itself but rather toward the relationship between one's own mind and the event in question. In other words, by taking the attitude of remembering toward a given event simulation, we do not represent the event but rather how we came to acquire a given belief based on that event. This is why we took episodic memory to be "epistemically generative": It represents explicitly the justification for endorsing a given belief.

Some commentators have claimed that it is a mistake to think that such a metarepresentational attitude is essential to the concept of episodic memory. Both **Carruthers** and **Werning & Cheng** remarked that such a metarepresentational form of memory is incidental and not the obligatory format of episodic memory. On their view, all of what episodic memory seems to do can be explained purely in terms of first-order content. Thus, although we might sometimes metarepresent the contents of episodic memory, just as we do with other mental contents, it might not be essentially metarepresentational. Indeed, we agree that it is not obvious why episodic memory should have a second-order component. The question why it nonetheless seems to include such a component provides the motivation for our functional account in the first place. Thus, even if it turned out that we were wrong in claiming that episodic memory obligatorily includes a metarepresentational component, an explanation would still be required for why we regularly metarepresent it in this way.

There are, however, good reasons to think that episodic memory proper indispensably invokes a dedicated form of metarepresentation. While it is true that the contents of episodic memory will usually possess features that will easily allow one to infer that the associated event was experienced, this inference still has to be carried out. And the outcome of such an inference will necessarily be metarepresentational by virtue of being *source* information (i.e., information about one's own beliefs). The second-order component, moreover, seems to have a distinct developmental trajectory (Haigh & Robinson 2009; Robinson & Whitcombe 2003; Whitcombe & Robinson 2000) and seems to produce signature deficits when lost (Klein & Nichols 2012). Indeed, the circumstance that there seems to be clear separability between the first- and second-order components of episodic memory prompted us to draw a distinction between episodic and event memory.

It is worth providing an example here. Take an instance of alcohol-induced amnesia: You might not remember that you texted your ex-partner when you were drunk last night. Now your friend who was with you at the time of the texting tells you about this episode. As a consequence, you form an accurate event simulation based on your friend's account of the events. The resulting representation will now have a lot of the features of episodic memory without being, strictly speaking, a memory: It will include a first-person perspective, it will be vivid, you will believe that the events it represents occurred, and you will also believe that you were the agent involved. Importantly, however, this representation will not include the crucial piece of source information telling you that you know about the events of last night through your own experience. After all, the source of your knowledge about the events in this case will be your friend's testimony and not your own experience. Thus, it will not be autonoetic in our sense[2] and will not fill the functional role of an episodic memory.[3] Hence, it seems clear that the bearer of such a representation will not claim to remember.

This example illustrates a number of things. First, it is clear here that autonoesis should not be taken to be part of the content of the memory. The content of the event simulation might be exactly the same regardless of whether you formed it on the basis of your friend's testimony or not. Second, we can see that source information is importantly different from agentive information: That is, knowing that "I did X" is not the same as knowing that "I know about X because I experienced it."

This is relevant for our understanding of the kind of self-reference at issue here. According to **Szpunar & Chan,** episodic memory is "key to the self in time." Indeed, the content of episodic memory might include agentive information about which actions you performed yourself and which you did not. As the previous example illustrates, however, episodic memory is not necessary for this because agentive and source information can be dissociated. While a temporally extended conception of the self is certainly part of what makes episodic memory effective, autonoetic memory is not necessary for it to occur.

Thus, **Rau & Botterill** might well be correct that trace information could be constituted by perceptual and motor models, which might underlie representations of agency at recall and help inform motor learning and action control. However, again, this alone is not sufficient for autonoesis (and hence episodic memory) to occur.

In the same vein, we find **Morton**'s description of research on patients with dissociative identity disorder fascinating. However, we do not perceive these phenomena as posing a problem for our account. On the contrary, **Morton**'s description of the underlying mechanisms seems entirely compatible with the general picture we at least intended to paint of the way autonoesis occurs. That is, we agree that an "agentive" notion of self might be part of the "addressable" content of episodic memory, while the "autonoetic" sense of self is likely the outcome of a metacognitive attribution process at the retrieval stage.

De Brigard & Gessell challenged our characterization of episodic memory from another angle. They argued that certain kinds of simulations of past counterfactual events have all of the features we identified as distinctive of episodic memory without being memories themselves. This claim seems surprising to us, because, if this was indeed the case, we would have difficulties telling these two kinds of mental activities apart in our daily lives. But the difference between past counterfactuals and actual episodic memories seems glaringly obvious: In the latter case, one takes oneself to have indeed experienced the event as it actually occurred, whereas, in the former case, one makes an inference from that experience as to what could have occurred if circumstances had been different. There are two important points to make here: (1) "Firsthand" information in the way we

https://doi.org/10.1017/S0140525X17000012 Published online by Cambridge University Press

used the term was not intended to mean something akin to "only I could know this."[4] It rather meant that the bearer of a given representation also represents that its contents were acquired through her own perception – something that is clearly not the case for the "subjunctive replays" of the kind described by **De Brigard & Gessell**. In other words, we do not consider counterfactual simulations – or any other epistemic metarepresentational attitudes (except remembering) – to be autonoetic. (2) Even though we agree with De Brigard (2013) that the mechanisms underlying content generation for both episodic memories and episodic counterfactuals are closely similar, their outputs crucially differ in intensional direction. Episodic memories present themselves as being directed toward actual experiences, while episodic counterfactuals do not. The fact that in actuality their representations are both outcomes of a best guess as to what is most likely to have occurred given certain assumptions does not make this difference irrelevant. In fact, it is exactly this difference that underlines **Michaelian**'s observation that episodic memory is systematically misleading (see R3.3.).

Importantly, the proposal that episodic memory proper is metarepresentational in nature does not entail that this representational format is due to a domain-general metarepresentational faculty. In fact, there are good reasons to think that metarepresentational capacities might be domain specific (e.g., Mercier & Sperber 2017; Sperber & Wilson 2002) and that general mind-reading abilities are (while related) importantly distinct from the kind of source representations involved in episodic memory (Rosenbaum et al. 2007; Naito 2003). Thus, it strikes us as unlikely that, as **Redshaw & Suddendorf** claimed, episodic memory should be a by-product of the application of domain-general metarepresentational capacities to the outputs of the scenario construction system. Instead, episodic memory is the outcome of a dedicated metarepresentational mechanism, which allows us to take the attitude of remembering toward certain mental contents.

R2.4. Epistemic generativity and the justificatory role of episodic memory

Werning & Cheng further argued that epistemic generativity and the epistemic privilegedness of episodic memory can be viewed as outcomes of purely first-order content. Here, unfortunately, our use of the term *epistemic generativity* has been misunderstood. **Werning & Cheng** seemed to have taken us to claim that the beliefs we form on the basis of episodic memory are epistemically justified in a normative sense. To be clear, we did not claim anything about whether episodic memory does in fact generate epistemic justification so understood. Rather, we propose that episodic memory plays the psychological role of supplying a justification for a given belief. It might be true that the processes underlying episodic memory construction are statistically reliable, and thus our beliefs formed on their basis can be taken to be epistemically justified such that we are epistemically entitled to them. But our point was a different one; namely, that when we remember, we know that we are justified in believing that a given event occurred precisely *because we remember it*.

Non-believed memories, as mentioned by **Nash** and **Blank**, provide a perfect illustration of this. In this case we do not take the fact that we remember to be good-enough reason to believe that a given event indeed occurred. Remembering the occurrence of an event is not always sufficient, let alone the only reason, to indeed believe in its occurrence. The fact that belief and episodic memory can dissociate in this way thus showcases that they stand in a psychological relation of justification.

Relatedly, our account aims to explain not why we *should* treat episodic memory as epistemically privileged in a normative sense. Rather, as pointed out by **Henry & Craver**, we explain why we often *do* treat contents made available through episodic memory as privileged. And that is because firsthand experience bestows epistemic authority in communication by making us accountable for its truth. And, to reiterate, representing a given episode as experienced firsthand requires a metacognitive inference.

R2.5. Distinguishing different kinds of memory

Another aspect relevant to determining the nature of episodic memory is its distinction from other kinds of memory. On the one hand, **Berntsen** and **Nelson** took issue with the fact that we did not discuss autobiographical memory. As mentioned in the target article (footnote 1), we do not take autobiographical memory to be a natural kind (Michaelian 2011b; 2016b). Rather, autobiographical memory is a specific type of memory content, which can be represented both in episodic and semantic memory. As such, the question of why we form such autobiographical memory contents is substantially different from the question of the function of episodic memory. Relatedly, **Rubin** and **Berntsen** pointed out that we did not reference work investigating the uses of autobiographical memory (e.g., Bluck et al. 2005; Harris et al. 2014). This strand of research did not make a clear distinction between episodic and autobiographical memory, and it investigated the function of autobiographical memory by explicitly asking participants about the role these memories play for them. Although the answers of participants in such situations can be revealing, it is not obvious what significance they have for investigating the proper function of episodic memory. As mentioned in the target article (sect. 2), the function of a cognitive capacity needs to be importantly distinguished from its uses, and therefore we did not take this work to be relevant to our question.

On the other hand, several authors have commented on the distinction between episodic and semantic memory. **Rubin** claimed that the distinction is becoming increasingly hard to see, and **Hayes, Ramanan, & Irish** (**Hayes et al.**) argued that semantic memory plays a significant role in episodic memory itself. Indeed, we agree that episodic and semantic memory are intricately intertwined. The scenario construction process underlying episodic memory draws heavily on semantic information, given that encoded traces are not event representations themselves (a point also emphasized by **Werning & Cheng**). In fact, we cited some of the work mentioned by Hayes et al. ourselves in pointing out that the construction of future-oriented as compared to past-oriented scenarios should rely more heavily on semantic information (Irish et al. 2012a). Despite this intricate relationship, we nonetheless maintain that it remains useful and meaningful to distinguish between the outputs of scenario construction (i.e., event and episodic memory) and the semantic memories serving as its inputs.

https://doi.org/10.1017/S0140525X17000012 Published online by Cambridge University Press

In a slightly different vein, **Nelson** expressed discontent with the developmental primacy of semantic over episodic memory implied in our account. Nelson seemed to suggest that both semantic and episodic memory emerge from a third kind of memory, which she termed *infant memory*. However, we do not perceive this view to necessarily stand in contradiction to our own account.

R3. The function of episodic memory

Many commentators focused on our claims about the function of episodic memory. It is worth reiterating here that our account was intended to explain why humans have developed the capacity to *remember* rather than simply *retain* traces of past experience or *believe* facts about events in the past. Why do humans, when we represent past events, commonly also represent how we came to know about them? Using the terminology we adopted in the target article, why do we have episodic memories and not just event memories? In our view, any functional account will have to account for (or at least debate) this difference. Let us also emphasize that our proposal viewed from this angle is much more modest than it might initially appear: Our account is aimed primarily at the metarepresentational component of episodic memory. While our view does have consequences for the contents of episodic memory, too, our main proposal is that episodic memory in humans is metarepresentational because it serves a role in communication.[5] Indeed, as emphasized by numerous contributors (**Blank**; **De Brigard & Gessell**; **Henry & Craver**; **Mar & Spreng**), the systems underlying the production of episodic memory content are likely to have been shaped by many different selection pressures. Our claim is simply that the role that episodic memory plays in communication provides a unified explanation of its central features: autonoesis, veridicality, and constructiveness.

Thus, **Samuel & Clayton** correctly pointed out that we assume a discontinuity between episodic memory in humans and in other animals: We predict that memories of past events in other animals lack a metarepresentational component.[6] Nonetheless, we perceive the falsifiability this commitment entails to be a strength rather than a weakness of our view. In fact, as **Henry & Craver** mentioned, our proposal might prove productive in suggesting new avenues for research on episodic memory in non-human animals.

Redshaw & Suddendorf emphasized that current adaptive value might not be identical to the selective forces that shaped the emergence of a given trait. We wholeheartedly agree with their cautionary note. While it is possible that episodic memory might not have been originally selected for the functions we have identified, only phylogenetic evidence could lend support to or contradict this claim. In the absence of appropriate phylogenetic evidence in this case, we maintain that form-to-function reasoning, which we adopted in the target article, provides the most promising strategy. Moreover, our view has the advantage of providing a unified functional explanation for the central features of episodic memory (i.e., veridicality, constructiveness, autonoesis, metarepresentational format), which other proposals could only partially account for.

R3.1. Episodic memory veridicality and mental time travel

One significant point of controversy emerging from the commentaries was our claim that the "mental time travel" view of episodic memory function would have trouble accounting for the veridicality that episodic memories frequently display. **Schacter, Carpenter, Devitt, Roberts, & Addis** (**Schacter et al.**) emphasized that the constructive episodic simulation hypothesis (Schacter & Addis 2007) assumes that accurate episodic memory supports the simulation of future scenarios. However, their use of the term *episodic memory* seems to differ from our own. Schacter & Madore (2016), which Schacter et al. cited to illustrate the contribution of veridical episodic memory to future imagination, stated that "remembering past experiences and imagining future experiences both rely heavily on a particular form of memory known as *episodic memory*" (p. 246, their emphasis). This suggests that episodic memory is viewed here as something that is prior to, and underlies, both future and past-directed simulation processes. According to Schacter (personal communication, June 28 2017), "episodic memory" here is meant to refer to "retrieved episodic information." To the extent that this implies that one does not first have to construct a simulation of a past event in order to construct a simulation of a future scenario, this view does not contradict our own account. Indeed, in the target article we concurred that future-oriented mental time travel should depend on, and make use of, episodic information in the form of memory traces originating from past experience. However, we questioned the claim that future-oriented mental time travel would benefit substantially from the capacity of veridical past-oriented mental time travel. A combination of established semantic memory plus trace information from past events could do all of the work here.

Benoit, Berkers, & Paulus (**Benoit et al.**) proposed an intriguing extension of the mental time travel view. One way to read their proposal is that episodic memory and episodic simulations in general serve to motivate prospective decisions based on non-occurrent information. This proposal resonates with views by Boyer (2008) and Hoerl & McCormack (2016), who similarly argued that episodic simulation in general, and episodic memory specifically, might function to implement certain emotion-based decisions. Indeed, one version of this proposal seems plausible: Episodic *simulation* does function to implement emotions in time. Because we can simulate a given non-occurrent event, we can concomitantly experience its emotional consequences, which should in turn influence decision making.[7] Benoit et al., however, seemed to restrict the role of episodic simulation merely to prospective emotions. This strikes us as unlikely: If anything, past-directed episodic simulations should be primarily geared toward guiding the emotional assessments of past events in the form of gratitude, guilt, shame, and so forth.[8]

All in all, as long as it is recognized that simulations of specific past events play a distinct, stand-alone role in motivating decisions based on non-occurrent information, we are sympathetic to views such as the one proposed by **Benoit et al.** Nonetheless, the functional role of veridicality in such an account remains unclear because appropriate (i.e., adaptive) motivation can be achieved independently from veridical representation. In fact, many motivational systems

https://doi.org/10.1017/S0140525X17000012 Published online by Cambridge University Press

seem to depend on misrepresentations to be effective (Kurzban 2012).

Moreover, this view is compatible with our own account only to the extent that the motivational role of episodic simulation is not dependent on a metarepresentational format. In fact, it is questionable whether **Benoit et al.** can account for the metarepresentational component distinctive of episodic memory.[9] While to some extent, this is surely an empirical question, there are some reasons to think that the distinctive metarepresentational component of episodic memory is not responsible for its emotional impact. Counterfactual and future-directed simulations have emotional consequences while differing in metarepresentational content from past-directed simulations. The fact that I have not yet experienced the future does nothing to lessen its potential emotional impact on me. Indeed, the earlier example of alcohol-induced amnesia illustrates this point perfectly: One can feel ashamed about having texted one's ex-partner when drunk without (strictly speaking) remembering anything about the event. Thus, it seems unlikely that the metarepresentational format of episodic memory is required for its role in generating emotions. Rather, its content (i.e., the simulation of a specific past event) seems to be doing the work here.

Note that the relationship between emotions and episodic memory emphasized here is different from the one discussed by **Eaton & Anderson**. They rightly remark on the role of emotions for the encoding of memory trace information and argue that this role is likely prior to the social functions of episodic memory. Indeed, as we have argued in the target article (sect. 4: Conclusions), the encoding of memory traces is likely influenced by many distinct mechanisms, because these traces themselves inform a plethora of processes. This fact in itself, however, does not preclude the finished product (episodic memory proper) to serve a crucial sociocommunicative function.

R3.2. The relationship between autonoesis, veridicality, and confidence

A range of commentators discussed our account of the relationship between autonoesis, veridicality, and confidence. On our view, autonoesis serves as a signal for the fact that one has epistemic authority about the contents of one's memories. Crucially, this has to be distinguished from both a signal of veridicality (**Blank**) and of confidence/certainty (**Werning & Cheng**).

On the one hand, distinguishing autonoesis from assessments of veridicality makes intelligible how "non-believed memories," as mentioned by **Nash** and **Blank**, are possible. Because judgments of the source of one's beliefs have to be distinguished from judgments about the truth of those beliefs, one can remember to have experienced something that one takes to not actually have occurred. This is presumably the reason why Johnson et al. (1993) distinguished two kinds of mechanisms responsible for these judgments: reality and source monitoring, respectively. Thus, *pace* **Blank**, the role of autonoesis as a signal of epistemic authority is not dependent on it signaling veridicality but rather accountability. By claiming that it originates in my own experience, I take personal responsibility for a given statement, and I make myself accountable in case of being found wrong, which should make my interlocutor more likely to rely on whatever I am stating. While this view predicts the statistical co-occurrence of autonoesis and veridicality, the relation between the two is mediated by other factors (such as whether or not veridicality can be monitored by others and the costs of being found wrong). This should also make clear why certainty or confidence judgments about the veridicality of one's recollections should be distinguished from autonoesis. First, confidence about the accuracy of the contents of a given event representation and confidence about the way one acquired it can be estimated separately from each other. Second, confidence reports have to be distinguished from the kind of evidential reports that autonoesis allows us to perform. This distinction is analogous to the distinction between evidentiality and modality in linguistics (e.g., De Haan 2001).

R3.3. Epistemic authority and issues of accuracy

Pace **Werning & Cheng**, we would thus insist that our account has little to say about the relationship between confidence reports and memory accuracy. This said, confidence reports can surely function as commitment devices (Vullioud et al. 2017). As such, while they should certainly be sensitive to accuracy, they should be influenced by other factors as well. Indeed, the relationship between these constructs is quite nuanced (see, e.g., DeSoto & Roediger 2014; Koriat & Adiv 2016; Wixted & Wells 2017).

One might think that we should instead claim that judgments of autonoesis should accurately track the origins of our event simulations. However, as **Michaelian** pointed out, scenario construction always makes use of an amalgamation of different sources of information. Episodic memory might thus be said to be misleading in principle about its metarepresentational component. In fact, there is no such thing as a piece of information purely acquired through firsthand experience. Rather, "firsthand experience" is a construct that serves a certain sociocommunicative purpose. It is attributed to certain mental contents in order to justify them rather than to accurately represent their origin. Thus, **Michaelian** is right: As a rule, autonoesis cannot be wholly accurate. Crucially, however, reason-providing cognitive capacities in general share this feature (Mercier & Sperber 2017): Because reasons serve to justify a given conclusion rather than to manage its truth value, they do not have to correspond to the actual causes for why one endorsed the conclusion in question in the first place.

Of course, this seemingly counter-intuitive implication of our proposal does not entail that there should not be certain constraints on when we take ourselves to have experienced something firsthand. Nonetheless, even the case of confabulations, as mentioned by **Robins**, is nothing extraordinary from this perspective. Rather, confabulations simply represent one extreme of the systematic misleadingness mentioned by **Michaelian**. In the memory manipulation paradigms *a la* Loftus & Pickrell (1995), participants construct an event simulation based on an experimentally induced belief about their own past and try to justify it through autonoetic remembering. The fact that this kind of behavior can be reliably induced experimentally in the laboratory only shows that episodic memory is sensitive to social demand characteristics. The phenomenon of confabulations itself thus in no way challenges the claim that

https://doi.org/10.1017/S0140525X17000012 Published online by Cambridge University Press

autonoesis in general serves as a signal of epistemic authority.

R3.4. The relation between episodic memory and commitments

A few authors commented on the relationship between autonoetic remembering and diachronic commitments in our account. Specifically, **Nagel** suggested that we got the role of remembering and social commitments the wrong way around. Instead of merely allowing us to negotiate commitments communicatively, it might be that self-referential remembering plays a role in implementing our capacity for diachronic commitment itself. Similarly, **Michael, Székely, & Christensen** argued that episodic memory contents can be important in determining whether a commitment has been incurred in the first place. Indeed, it might well be that there has been pressure on the episodic memory system to encode details of events in order to be able to later justify certain interpretations of them. And this mechanism in turn might play a role in implementing commitment insofar as one takes oneself to be committed to whatever is justifiable. This might explain findings such as those described by **Fabbro & Crescentini**, in which a connection between anti-social behavior (particularly in the communicative domain) and episodic memory deficits emerges.

One way in which this mechanism might operate is through the kind of emotional retrospection mentioned in our discussion of **Benoit et al.**'s remarks. That is, the commitment situation might carry motivational force through time by way of the emotional consequences of remembering it. Crucially, however, this mechanism would be based exclusively on an "agentive" notion of self without appealing to the "autonoetic" self that operates in episodic memory. Put differently, first-order memory content, referring to the self, could be entirely sufficient for the implementation of commitment itself without representing the source of this content. The constitutive role of episodic memory in social commitments suggested by **Nagel** might thus be supported by the agentive notion of self involved in episodic simulations. In sum, the role of self-referential memory in social commitments may go both ways by supporting both their motivational force as well as their social enforcement.

R4. Conclusion

Episodic memory is often viewed as something central to being human. Nonetheless, as the commentaries to our article glaringly show, there is anything but a consensus on the questions of the nature and the function of episodic memory. We hope that our account will contribute to enliven the debate surrounding the questions raised here. Despite the many different perspectives and criticisms offered in the commentaries, we have found much of value in them, and they have allowed us to extend our account in multiple directions.

To sum up, let us highlight the most significant of these extensions again. In response to **Keven**'s remarks, we realized that episodic memory construction might go beyond the construction processes involved in event memory. In fact, this extension of the constructive process is required by our own account as well. The insistence of several authors, such as **Werning & Cheng** and **Carruthers**, that a form of autonoesis might be part of the first-order content of episodic memory allowed us to clarify our concept of autonoesis. As a consequence, we understood that autonoesis as a form of source information should be distinguished from information about agency. **Michaelian**'s insightful comments allowed us to emphasize that such source information is always to some extent misleading and therefore constructed primarily in the service of justification. Finally, **Nagel**'s commentary helped us realize that the agentive element of episodic memory might support diachronic commitments not only by allowing their communicative enforcement after the fact, but also by making them effective through time in the first place. This in turn might be achieved through a mechanism implementing emotions in time, as suggested by **Benoit et al.** Of course, many of these ideas remain speculative. Nonetheless, we are optimistic that they will prove stimulating in guiding empirical research and theoretical debate.

NOTES

1. Since patient RB reportedly recovered from his symptoms completely, we acknowledge that conclusive evidence for the existence of such a double dissociation is still outstanding.

2. According to commentators such as **De Brigard & Gessell** and **Benoit et al.,** however, such a representation would likely count as autonoetic nonetheless.

3. Of course, you might forget with time that your representation of the events in question was not based on your own experience and simply treat it as an episodic memory. As we have argued in the target article, this is likely what occurs in the misinformation paradigm (Loftus 2005).

4. This point is also relevant for **Nagel**'s alternative proposal of the function of autonoesis.

5. Also, as emphasized in the target article, we view episodic memory primarily as a *retrieval phenomenon* (Klein 2013b): Encoded information, while different from semantic memory, is not yet episodic memory.

6. Note that, on our view, even if it were found that nonhuman animals are capable of forming metarepresentations in general, this would not automatically show that they possess the domain specific metarepresentational capacity required for episodic memory.

7. One important question, however, concerns why one would have to represent the event itself episodically in order to experience its emotional consequences. Semantic information might, in principle, have the same impact (e.g., knowing that my cat died yesterday might make me sad without representing the event as such at all). One possible explanation why event simulation is important here might be that it represents the reasons for a given emotional state. In fact, some emotional states seem to depend on such a reason being available (one can only forgive someone *for something*, feel guilty *for something*, and so on).

8. Of course, emotions are simply one form of decision-making capacity and, as such, are always implicitly future-oriented. Nonetheless, not all emotions are oriented toward the future in the sense of being about the future.

9. Benoit et al. assume an entirely different view of autonoesis from ours. They take the quasi-experiential character of episodic simulation (Russell & Hanna 2012) to be sufficient for autonoesis. While we agree that it may be this feature of episodic simulation that drives its emotional effects, we maintain that autonoesis is the outcome of a distinct, metarepresentational component, which is not explained by the role of episodic simulation in emotion generation.

https://doi.org/10.1017/S0140525X17000012 Published online by Cambridge University Press

References

[The letters "a" and "r" before author's initials stand for target article and response references, respectively]

Addis, D. R., Pan, L., Vu, M. A., Laiser, N. & Schacter, D. L. (2009) Constructive episodic simulation of the future and the past: Distinct subsystems of a core brain network mediate imagining and remembering. *Neuropsychologia* 47 (11):2222–38. [aJBM, DLS]

Addis, D. R., Wong, A. T. & Schacter, D. L. (2007) Remembering the past and imagining the future: Common and distinct neural substrates during event construction and elaboration. *Neuropsychologia* 45(7):1363–77. https://doi.org/10.1016/j.neuropsychologia.2006.10.016. [aJBM, RGB, JR]

Addis, D. R., Wong, A. T. & Schacter, D. L. (2008) Age-related changes in the episodic simulation of future events. *Psychological Science* 19(1):33–41. https://doi.org/10.1111/j.1467-9280.2008.02043.x. [RGB]

Aikhenvald, A. (2004) *Evidentiality*. Oxford University Press. [aJBM]

Alba, J. W. & Hasher, W. L. (1983) Is memory schematic? *Psychological Bulletin* 93 (2):203–31. Available at: http://psycnet.apa.org/index.cfm?fa=search.displayRecord&uid=1983-20271-001. [aJBM, BKH]

Allan, K., Midjord, P., Martin, D. & Gabbert, F. (2012) Memory conformity and the perceived accuracy of self versus other. *Memory & Cognition* 40:280–86. Available at: http://link.springer.com/article/10.3758/s13421-011-0141-9. [aJBM]

American Psychiatric Association (2013) *Diagnostic and statistical manual of mental disorders*, 5th edition. American Psychiatric Association. Available at: https://doi.org/10.1176/appi.books.9780890425596. [JMo]

Anderson, J. R. & Ross, B. H. (1980) Evidence against a semantic-episodic distinction. *Journal of Experimental Psychology: Human Learning and Memory* 6:441–66. [DCR]

Anderson, M. C. & Hanslmayr, S. (2014) Neural mechanisms of motivated forgetting. *Trends in Cognitive Sciences* 18(6):279–92. Available at: http://www.sciencedirect.com/science/article/pii/S1364661314000746. [aJBM, FF]

Andrews-Hanna, J. R., Smallwood, J. & Spreng, R. N. (2014) The default network and self-generated thought: Component processes, dynamic control, and clinical relevance. *Annals of the New York Academy of Sciences* 1316:29–52. [RAM]

Asefi, S. L. & Garry, M. (2003) Absolut® memory distortions: Alcohol placebos influence the misinformation effect. *Psychological Science* 14(1):77–80. Available at: http://pss.sagepub.com/content/14/1/77.short. [aJBM]

Atance, C. M. & O'Neill, D. K. (2001) Episodic future thinking. *Trends in Cognitive Sciences* 5(12):533–39. Available at: http://www.sciencedirect.com/science/article/pii/S1364661300018040. [aJBM]

Audi, R. (1995) Memorial justification. *Philosophical Topics* 23(1):31–45. Available at: http://www.jstor.org/stable/43154193. [aJBM]

Babb, S. J. & Crystal, J. D. (2006) Episodic-like memory in the rat. *Current Biology* 16(13):1317–21. [NK]

Bahrami, B., Olsen, K., Latham, P. E., Roepstorff, A., Rees, G. & Frith, C. D. (2010) Optimally interacting minds. *Science* 329(5995):1081–85. [JN]

Barsalou, L. W. (1988) The content and organization of autobiographical memories. In: *Remembering reconsidered: Ecological and traditional approaches to the study of memory*, ed. U. Neisser, pp. 193–243. Cambridge University Press. [DCR]

Bartlett, F. C. (1932) *Remembering: A study in experimental and social psychology*. Cambridge University Press. [aJBM, DB, DCR]

Basile, B. M., Schroeder, G. R., Brown, E. K., Templer, V. L. & Hampton, R. R. (2015) Evaluation of seven hypotheses for metamemory performance in rhesus monkeys. *Journal of Experimental Psychology: General* 144(1):85–102. [SS]

Bateson, P. & Laland, K. N. (2013) Tinbergen's four questions: An appreciation and an update. *Trends in Ecology & Evolution* 28(12):712–18. [JR]

Bauer, P. J. & Leventon, J. S. (2013) Memory for onetime experiences in the second year of life: Implications for the status of episodic memory. *Infancy* 18(5):755–81. Available at: http://onlinelibrary.wiley.com/doi/10.1111/infa.12005/abstract. [aJBM]

Beadle, J. N., Tranel, D., Cohen, N. J. & Duff, M. C. (2013) Empathy in hippocampal amnesia. *Frontiers in Psychology* 4:69. [RAM]

Beike, D. R., Brandon, N. R. & Cole, H. E. (2016) Is sharing specific autobiographical memories a distinct form of self-disclosure? *Journal of Experimental Psychology: General* 145(4):434–50. [RF]

Bell, B. E. & Loftus, E. F. (1988) Degree of detail of eyewitness testimony and mock juror judgments. *Journal of Applied Social Psychology* 18(14):1171–92. Available at: http://onlinelibrary.wiley.com/doi/10.1111/j.1559-1816.1988.tb01200.x/full. [aJBM]

Bell, B. E. & Loftus, E. F. (1989) Trivial persuasion in the courtroom: The power of (a few) minor details. *Attitudes and Social Cognition* 56(5):669–79. Available at: http://psycnet.apa.org/journals/psp/56/5/669/. [aJBM, RAN]

Bell, R., Schain, C. & Echterhoff, G. (2014) How selfish is memory for cheaters? Evidence for moral and egoistic biases. *Cognition* 132:437–42. Available at: http://www.sciencedirect.com/science/article/pii/S0010027714000845. [aJBM]

Benney, K. S. & Henkel, L. A. (2006) The role of free choice in memory for past decisions. *Memory* 14(8):1001–11. Available at: http://www.tandfonline.com/doi/abs/10.1080/09658210601046163. [aJBM]

Benoit, R. G., Gilbert, S. J. & Burgess, P. W. (2011) A neural mechanism mediating the impact of episodic prospection on farsighted decisions. *The Journal of Neuroscience* 31(18):6771–79. Available at: https://doi.org/10.1523/JNEUROSCI.6559-10.2011. [RGB, KKS]

Benoit, R. G. & Schacter, D. L. (2015) Specifying the core network supporting episodic simulation and episodic memory by activation likelihood estimation. *Neuropsychologia* 75:450–57. Available at: https://doi.org/10.1016/j.neuropsychologia.2015.06.034. [RGB]

Bernstein, D. M. & Loftus, E. F. (2009) The consequences of false memories for food preferences and choices. *Perspectives on Psychological Science* 4:135–39. [RAN]

Berntsen, D. (2009) *Involuntary autobiographical memories. An introduction to the unbidden past*. Cambridge University Press. [DB]

Binder, J. R. & Desai, R. H. (2011) The neurobiology of semantic memory. *Trends in Cognitive Sciences* 15(11):527–36. Available at: doi:10.1016/j.tics.2011.10.001. [BKH]

Binder, J. R., Desai, R. H., Graves, W. W. & Conant, L. L. (2009) Where is the semantic system? A critical review and meta-analyses of 120 functional neuroimaging studies. *Cerebral Cortex* 19(12):2767–96. [BKH]

Bird, A. & Reese, E. (2006) Emotional reminiscing and the development of an autobiographical self. *Developmental Psychology* 42(4):613–25. [RF]

Blank, H. (2009) Remembering: A theoretical interface between memory and social psychology. *Social Psychology* 40(3):164–75. Available at: http://econtent.hogrefe.com/doi/abs/10.1027/1864-9335.40.3.164. [aJBM, HB, RAN]

Blank, H. (2017) Recollection, belief and metacognition: A reality check. *Memory* 25: 869–75. [HB]

Blank, H. & Launay, C. (2014) How to protect eyewitness memory against the misinformation effect: A meta-analysis of post-warning studies. *Journal of Applied Research in Memory and Cognition* 3:77–88. Available at: http://www.sciencedirect.com/science/article/pii/S2211368114000230. [aJBM]

Blank, H., Walther, E. & Isemann, S. D. (2017) The past is a social construction: Susceptibility to social influence in (mis)remembering. In: *False and distorted memories*, ed. R. A. Nash & J. Ost, pp. 55–71. Psychology Press. [HB]

Bluck, S. Alea, N., Habermas, T. & Rubin, D. C. (2005) A TALE of three functions: The self-reported uses of autobiographical memory. *Social Cognition* 23(1):91–117. [DB, WH, RAN, DCR, rJBM,]

Boals, A. & Klein, K. (2005) Word use in emotional narratives about failed romantic relationships and subsequent mental health. *Journal of Language and Social Psychology*, 24:252–68. [DCR]

Bookbinder, S. H. & Brainerd, C. J. (2017) Emotionally negative pictures enhance gist memory. *Emotion* 17(1):102–19. [TE]

Bordo, S. (1990) Feminism, postmodernism and gender skepticism. In: *Feminism/postmodernism*, ed. L. Nicholson, pp. 133–56. Routledge. [RF]

Boyer, P. (2008) Evolutionary economics of mental time travel? *Trends in Cognitive Sciences* 12(6):219–24. Available at: https://doi.org/10.1016/j.tics.2008.03.003. [arJBM, RGB]

Boyer, P. (2009) What are memories for? Functions of recall in cognition and culture. In: *Memory in mind and culture*, ed. P. Boyer & J. V. Wertsch, pp. 3–28. Cambridge University Press. [aJBM]

Bracken, P. J., Giller, J. E. & Summerfield, D. (1995) Psychological responses to war and atrocity: The limitations of current concepts. *Social Science of Medicine* 40 (8):1073–82. [RF]

Brainerd, C. J., Stein, L. M., Silveira, R. A., Rohenkohl, G. & Reyna, V. F. (2008) How does negative emotion cause false memories? *Psychological Science* 19 (9):919–25. [TE]

Brandom, R. (1983) Asserting. *Nous* 17(4):637–50. Available at: https://www.jstor.org/stable/2215086. [aJBM]

Bregman, N. J. & McAllister, H. A. (1982) Eyewitness testimony: The role of commitment in increasing reliability. *Social Psychology Quarterly* 45(3):181–84. Available at: http://www.jstor.org/stable/3033652. [aJBM]

Brewer, W. F. (1986) What is autobiographical memory? In: *Autobiographical memory*, ed. D. C. Rubin, pp. 25–49. Cambridge University Press. [DCR]

Bright-Paul, A., Jarrold, C. & Wright, D. B. (2005) Age-appropriate cues facilitate source-monitoring and reduce suggestibility in 3- to 7-year-olds. *Cognitive Development* 20:1–18. Available at: http://www.sciencedirect.com/science/article/pii/S0885201404000577. [aJBM]

Brosnan, S. F. & de Waal, F. B. (2002) A proximate perspective on reciprocal altruism. *Human Nature* 13(1):129–52. Available at: http://link.springer.com/article/10.1007/s12110-002-1017-2. [aJBM]

Brown, A. S., Hornstein, S. & Memon, A. (2006) Tracking conversational repetition: An evaluation of target monitoring ability. *Applied Cognitive Psychology* 20 (1):85–95. [MEH]

Buckner, R. L. & Carroll, D. C. (2006) Self-projection and the brain. *Trends in Cognitive Science* 11(2):49–57. Available at: http://www.sciencedirect.com/science/article/pii/S1364661306003275. [aJBM]

https://doi.org/10.1017/S0140525X17000012 Published online by Cambridge University Press

Burge, T. (1993) Content preservation. *The Philosophical Review* 102(4):457–88. Available at: http://www.jstor.org/stable/2185680. [aJBM]

Burianová, H., McIntosh, A. R. & Grady, C. L. (2010) A common functional brain network for autobiographical, episodic, and semantic memory retrieval. *NeuroImage* 49(1):865–74. Available at: https://doi.org:10.1016/j.neuroimage.2009.08.066. [BKH]

Burns, P., Russell, C. & Russell, J. (2015) Pre-school children's proto-episodic memory assessed by deferred imitation. *Memory* 23(8):1172–92. Available at: http://www.tandfonline.com/doi/abs/10.1080/09658211.2014.963625. [aJBM]

Busby, J. & Suddendorf, T. (2005) Recalling yesterday and predicting tomorrow. *Cognitive Development* 20(3):362–72. Available at: https://doi.org/10.1016/j.cogdev.2005.05.002. [RGB, JR]

Buzsáki, G. (2005) Theta rhythm of navigation: Link between path integration and landmark navigation, episodic and semantic memory. *Hippocampus* 15(7):827–40. [SA]

Cabeza, R., Prince, S. E., Daselaar, S. M., Greenberg, D. L., Budde, M., Dolcos, F., LaBar, K. S. & Rubin, D. C. (2004) Brain activity during episodic retrieval of autobiographical and laboratory events: An fMRI study using a novel photo paradigm. *Journal of Cognitive Neuroscience* 16:1583–94. [DCR]

Cabeza, R. & St. Jacques, P. (2007) Functional neuroimaging of autobiographical memory. *Trends in Cognitive Science* 11:219–27. [DCR]

Camille, N., Coricelli, G., Sallet, J., Pradat-Diehl, P., Duhamel, J.-R. & Sirigu, A. (2004) The involvement of the orbitofrontal cortex in the experience of regret. *Science* 304(5674):1167–70. Available at: https://doi.org/10.1126/science.1094550. [RGB]

Campbell, D. T. (1983) Two distinct routes beyond kin selection to ultrasociality: Implications for the humanities and social sciences. In: *The nature of prosocial development: Theories and strategies*, ed. D. Bridgeman, pp. 11–41. Academic Press. [WH]

Carpenter, A. C. & Schacter, D. L. (2017) Flexible retrieval: When true inferences produce false memories. *Journal of Experimental Psychology: Learning, Memory, and Cognition* 43:335–49. [DLS]

Carruthers, P. (2011) *The opacity of mind*. Oxford University Press. [PC]

Castelain, T., Bernard, S., Van der Henst, J. & Mercier, H. (2015) The influence of power and reason on young Maya children's endorsement of testimony. *Developmental Science* 19(6)957–66. Available at: http://onlinelibrary.wiley.com/doi/10.1111/desc.12336/abstract. [aJBM]

Chandler, M. J. & Lalonde, C. (1998) Cultural continuity as a hedge against suicide in Canada's First Nations. *Transcultural Psychiatry* 35(2):191–219. [RF]

Chapman, H. A., Johannes, K., Poppenk, J. L., Moscovitch, M. & Anderson, A. K. (2013) Evidence for the differential salience of disgust and fear in episodic memory. *Journal of Experimental Psychology: General* 142(4):1100–12. [TE]

Cheke, L. G. & Clayton, N. S. (2010) Mental time travel in animals. *Wiley Interdisciplinary Reviews: Cognitive Science* 1(6):915–30. [SS]

Cheney, D. L. & Seyfarth, R. M. (1988) Assessment of meaning and the detection of unreliable signals by vervet monkeys. *Animal Behaviour* 36(2):477–86. [SS]

Cheng, S. & Werning, M. (2013) Composition and replay of mnemonic sequences? The contributions of REM and slow-wave sleep to episodic memory. *Behavioral and Brain Sciences* 36(6):610–11. Available at: https://doi.org/10.1017/S0140525X13001234. [MW]

Cheng, S. & Werning, M. (2016) What is episodic memory if it is a natural kind? *Synthese* 193(5):1345–85. Available at: https://doi.org/10.1007/s11229-014-0628-6. [MW]

Cheng, S., Werning, M. & Suddendorf, T. (2016) Dissociating memory traces and scenario construction in mental time travel. *Neuroscience and Biobehavioral Reviews* 60:82–89. Available at: https://doi.org/10.1016/j.neubiorev.2015.11.011. [aJBM, JR, MW]

Cicero, M. T. (55 BCE/1948) *Cicero: On the orator, Books I-II* (Loeb Classical Library No. 348) (English and Latin Edition), trans. E. W. Sutton & H. Rackham. Harvard University Press. [SA]

Clancy, S. A., McNally, R. J., Schacter, D. L., Lenzenweger, M. F. & Pittman, R. K. (2002) Memory distortions in people reporting abduction by aliens. *Journal of Abnormal Psychology* 111:455–61. [SR]

Clark, A. (2013) Whatever next? Predictive brains, situated agents, and the future of cognitive science. *Behavioral and Brain Sciences* 36(3):181–204. Available at: doi:10.1017/S0140525X12000477. [PR]

Clark, A. (2014) Perceiving as predicting. In: *Perception and its modalities*, ed. D. Stokes, M. Matthen & S. Biggs, pp. 23–43. Oxford University Press. Available at: https://doi.org/10.1093/acprof:oso/9780199832798.001.0001. [PR]

Clark, A., Nash, R. A., Fincham, G. & Mazzoni, G. (2012) Creating non-believed memories for recent autobiographical events. *PLoS ONE* 7:e32998. [RAN]

Clark-Foos, A., Brewer, G. & Marsh, R. L. (2015) Judging the reality of others' memories. *Memory* 23(3):427–36. Available at: http://www.tandfonline.com/doi/abs/10.1080/09658211.2014.893364. [aJBM]

Clayton, N. S. & Dickinson, A. (1998) Episodic-like memory during cache recovery by scrub jays. *Nature* 395(6699):272–74. Available at: http://www.nature.com/nature/journal/v395/n6699/abs/395272a0.html. [aJBM, JH, NK, PR, SS]

Clayton, N. S. & Dickinson, A. (1999a) Memory for the content of caches by scrub jays (*Aphelocoma coerulescens*). *Journal of Experimental Psychology: Animal Behavior Processes* 25(1):82–91. [SS]

Clayton, N. S. & Dickinson, A. (1999b) Scrub jays (*Aphelocoma coerulescens*) remember the relative time of caching as well as the location and content of their caches. *Journal of Comparative Psychology* 113(4):403–16. [SS]

Clayton, N. S. & Russell (2009) Looking for episodic memory in animals and young children: Prospects for a new minimalism. *Neuropsychologia* 47(11):2330–40. Available at: http://www.sciencedirect.com/science/article/pii/S0028393208004132. [aJBM, SS]

Clayton, N. S., Yu, K. S. & Dickinson, A. (2001) Scrub jays (*Aphelocoma coerulescens*) form integrated memories of the multiple features of caching episodes. *Journal of Experimental Psychology: Animal Behavior Processes* 27(1):17–29. [SS]

Clayton, N. S., Yu, K. S. & Dickinson, A. (2003) Interacting cache memories: Evidence for flexible memory use by Western scrub-jays (*Aphelocoma californica*). *Journal of Experimental Psychology: Animal Behavior Processes* 29(1):14–22. [SS]

Clément, F., Koenig, M. & Harris, P. (2004) The ontogenesis of trust. *Mind & Language* 19(4):360–79. Available at: http://onlinelibrary.wiley.com/doi/10.1111/j.0268-1064.2004.00263.x/abstract. [aJBM]

Clifasefi, S. L., Garry, M., Harper, D. N., Sharman, S. J. & Sutherland, R. (2007) Psychotropic placebos create resistance to the misinformation effect. *Psychonomic Bulletin & Review* 14(1):112–17. Available at: http://link.springer.com/article/10.3758/BF03194037. [aJBM]

Cochran, K. J., Greenspan, R. L., Bogart, D. F. & Loftus, E. F. (2016) Memory blindness: Altered memory reports lead to distortion in eyewitness testimony. *Memory & Cognition* 44(5):717–26. Available at: http://link.springer.com/article/10.3758/s13421-016-0594-y. [aJBM]

Coman, A. (2015) The psychology of collective memory. In: *International Encyclopedia of the Social & Behavioral Sciences*, *vol. 4*, 2nd edition, ed. J. D. Wright, pp. 188–93. Elsevier. [AC]

Coman, A. & Hirst, W. (2012) Cognition through a social network: The propagation of induced forgetting and practice effects. *Journal of Experimental Psychology: General* 141:321–36. [AC]

Coman, A. & Hirst, W. (2015) Relational motives and socially shared retrieval induced forgetting: The role of social group membership. *Journal of Experimental Psychology: General* 144:717–22. [AC]

Coman, A., Stone, C. B., Castano, E. & Hirst, W. (2014) Justifying atrocities: The effect of moral-disengagement strategies on socially shared retrieval-induced forgetting. *Psychological Science* 25(6):1281–85. Available at: http://pss.sagepub.com/content/early/2014/04/16/0956797614531024. [aJBM]

Conway, M. A. (2005) Memory and the self. *Journal of Memory and Language* 53:594–628. Available at: http://www.sciencedirect.com/science/article/pii/S0749596X05000987. [aJBM]

Conway, M. A. (2009) Episodic memories. *Neuropsychologia* 47(11):2305–13. [JMi]

Conway, M. A. & Pleydell-Pearce, C. W. (2000) The construction of autobiographical memories in the self-memory system. *Psychological Review* 107:261–88. [DB, RAN]

Conway, M. A., Singer, J. A. & Tagini, A. (2004) The self and autobiographical memory: Correspondence and coherence. *Social Cognition* 22(5):491–529. [RF]

Cook, J. M., Riggs, D. S., Thompson, R., Coyne, J. C. & Sheikh, J. I. (2004) Posttraumatic stress disorder and current relationship functioning among World War II ex-prisoners of war. *Journal of Family Psychology* 18(1):36–45. [TE]

Corballis, M. C. (2013) Mental time travel: A case for evolutionary continuity. *Trends in Cognitive Sciences* 17(1):5–6. Available at: http://www.sciencedirect.com/science/article/pii/S1364661312002458. [aJBM]

Corkin, S. (2013) *Permanent present tense. The unforgettable life of the amnesic patient H.M.* Basic Books. [FDB, KKS]

Cosmides, L. (1989) The logic of social exchange: Has natural selection shaped how humans reason? Studies with the Wason selection task. *Cognition* 31(3):187–276. Available at: doi:10.1016/0010-0277(89)90023-1. [PR]

Cosmides, L. & Tooby, J. (1992) Cognitive adaptations for social exchange. In: *The adapted mind: Evolutionary psychology and the generation of culture*, ed. J. Barkow, L. Cosmides & J. Tooby, pp. 163–228. Oxford University Press. [PR]

Cosmides, L. & Tooby, J. (2000) Consider the source: The evolution of adaptations for decoupling and metarepresentation. In: *Metarepresentations: A multidisciplinary perspective*, ed. D. Sperber, pp. 53–115. Vancouver Studies in Cognitive Science. Oxford University Press. [aJBM, DK]

Craver, C. F., Cova, F., Green, L., Myerson, J., Rosenbaum, R. S., Kwan, D. & Bourgeois-Gironde, S. (2014a) An Allais paradox without mental time travel. *Hippocampus* 24:1375–80. Available at: http://onlinelibrary.wiley.com/doi/10.1002/hipo.22318/full. [aJBM]

Craver, C. F., Kwan, D., Steindam, C. & Rosenbaum, R. S. (2014b) Individuals with episodic amnesia are not stuck in time. *Neuropsychologia* 57:191–95. Available at: http://www.sciencedirect.com/science/article/pii/S0028393214000797. [aJBM, RGB]

https://doi.org/10.1017/S0140525X17000012 Published online by Cambridge University Press

Crystal, J. D., Alford, W. T., Zhou, W. & Hohmann, A. G. (2013) Source memory in the rat. *Current Biology* 23:387–91. Available at: https://www.ncbi.nlm.nih.gov/pubmed/23394830. [aJBM]

Cuc, A., Koppel, J. & Hirst, W. (2007) Silence is not golden: A case for socially shared retrieval-induced forgetting. *Psychological Science* 18:727–33. [AC]

D'Argembeau, A., Comblain, C. & Van der Linden, M. (2003) Phenomenal characteristics of autobiographical memories for positive, negative, and neutral events. *Applied Cognitive Psychology* 17(3):281–94. Available at: https://doi.org/10.1002/acp.856. [RGB]

D'Argembeau, A. & Van der Linden, M. (2004) Phenomenal characteristics associated with projecting oneself back into the past and forward into the future: Influence of valence and temporal distance. *Consciousness and Cognition* 13 (4):844–58. [JR]

Dalgleish, T., Navrady, L., Bird, E., Hill, E., Dunn, B. D. & Golden, A. (2013) Method-of-loci as a mnemonic device to facilitate access to self-affirming personal memories for individuals with depression. *Clinical Psychological Science* 1:156–62. [SA]

Dally, J. M., Emery, N. J. & Clayton, N. S. (2006) Food-caching western scrub-jays keep track of who was watching when. *Science* 312(5780):1662–65. [SS]

Davidson, P. S., Drouin, H., Kwan, D., Moscovitch, M. & Rosenbaum, R. S. (2012) Memory as social glue: Close interpersonal relationships in amnesic patients. *Frontiers in Psychology* 3:531. [RAM]

Dawkins, R. & Krebs, J. R. (1978) Animal signals: Information or manipulation. In: *Behavioral ecology: An evolutionary approach*, ed. J. R. Krebs & N. B. Davies, pp. 282–309. Basil Blackwell Scientific. [aJBM]

De Brigard, F. (2012) Predictive memory and the surprising gap. *Frontiers in Psychology* 3:420. Available at: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3498899/. [aJBM]

De Brigard, F. (2014a) Is memory for remembering? Recollection as a form of episodic hypothetical thinking. *Synthese* 191(2):155–85. Available at: http://link.springer.com/article/10.1007/s11229-013-0247-7. [arJBM, FDB, JH, KM]

De Brigard, F. (2014b) The nature of memory traces. *Philosophy Compass* 9 (6):402–14. Available at: http://onlinelibrary.wiley.com/doi/10.1111/phc3.12133/abstract. [aJBM]

De Brigard, F., Addis, D., Ford, J. H., Schacter, D. L. & Giovanello, K. S. (2013) Remembering what could have happened: Neural correlates of episodic counterfactual thinking. *Neuropsychologia* 51(12):2401–14. [FDB]

De Brigard, F. & Giovanello, K. S. (2012) Influence of outcome valence in the subjective experience of episodic past, future and counterfactual thinking. *Consciousness and Cognition* 21(3):1085–96. [FDB]

De Haan, F. (2001) The relation between modality and evidentiality. *Linguistische Berichte* 9:201–16. [rJBM]

de Kort, S. R., Dickinson, A. & Clayton, N. S. (2005) Retrospective cognition by food-caching Western scrub-jays. *Learning and Motivation* 36(2):159–76. [SS]

DeSoto, K. A. & Roediger, H. L. (2014) Positive and negative correlations between confidence and accuracy for the same events in recognition of categorized lists. *Psychological Science* 25(3):781–88. [rJBM]

Dessalles, J.-L. (2007a) Storing events to retell them (Commentary on Suddendorf and Corballis: "The evolution of foresight"). *Behavioral and Brain Sciences* 30 (3):321–22. Available at: http://www.dessalles.fr/papers/Dessalles_07051403.pdf. [aJBM, J-LD]

Dessalles, J.-L. (2007b) *Why we talk: The evolutionary origins of language*. Oxford University Press. [aJBM]

Dessalles, J.-L. (2014) Why talk? In: *The social origins of language*, ed. D. Dor, C. Knight & J. Lewis, pp. 284–96. Oxford University Press. Available at: http://www.dessalles.fr/papers/Dessalles_12031903.pdf. [J-LD]

Dessalles, J.-L. (2017) Conversational topic connectedness predicted by simplicity theory. *Proceedings of the 39th Annual Conference of the Cognitive Science Society*, London, UK, 26–29 July 2017, ed. G. Gunzelmann, A. Howes, T. Tenbrink & E. Davelaar, pp. 1914–19. Cognitive Science Society. Available at: https://mindmodeling.org/cogsci2017/papers/0368/. [J-LD]

Deutsch, D. (1997) *The fabric of reality*. Viking. [FF]

Devitt, A. L., Monk-Fromont, E., Schacter, D. L. & Addis, D. R. (2016) Factors that influence the generation of autobiographical memory conjunction errors. *Memory* 24:204–22. [DLS]

Devitt, A. L. & Schacter, D. L. (2016) False memories with age: Neural and cognitive underpinnings. *Neuropsychologia* 91:346–59. [DLS]

Devnani, P. A. & Hegde, A. U. (2015) Autism and sleep disorders. *Journal of Pediatric Neurosciences* 10:304–307. [SD]

Dew, I. T. Z. & Cabeza, R. (2011) The porous boundaries between explicit and implicit memory: Behavioral and neural evidence. *Annals of the New York Academy of Sciences* 1224(1):174–90. Available at: http://onlinelibrary.wiley.com/doi/10.1111/j.1749-6632.2010.05946.x/full. [aJBM]

Dickerson, B. C. & Eichenbaum, H. (2010) The episodic memory system: Neurocircuitry and disorders. *Neuropsychopharmacology* 35:86–104. [KKS]

Diekelmann, S. & Born, J. (2010) The memory function of sleep. *Nature Reviews Neuroscience* 11:114–26. [SD]

Diekelmann, S., Born, J. & Wagner, U. (2010) Sleep enhances false memories depending on general memory performance. *Behavioural Brain Research* 208:425–29. [SD]

Diekelmann, S., Wilhelm, I., Wagner, U. & Born, J. (2013) Sleep to implement an intention. *Sleep* 36:149–53. [SD]

Dodd, D. H. & Bradshaw, J. M. (1980) Leading questions and memory: Pragmatic constraints. *Journal of Verbal Learning and Verbal Behavior* 19:695–704. Available at: http://www.sciencedirect.com/science/article/pii/S0022537180903795. [aJBM]

Dokic, J. (2001) Is memory purely preservative? In: *Time and memory: Issues in philosophy and psychology*, ed. C. Hoerl & T. McCormack, pp. 213–32. Oxford University Press. [aJBM]

Dokic, J. (2014) Feeling the past: A two-tiered account of episodic memory. *Review of Philosophy and Psychology* 5(3):413–26. [KM]

Drummey, A. B. & Newcombe, N. S. (2002) Developmental changes in source memory. *Developmental Science* 5(4):502–13. Available at: https://www.ncbi.nlm.nih.gov/pubmed/21883163. [aJBM]

Dudai, Y. & Carruthers, M. (2005) The Janus face of mnemosyne. *Nature* 434:823–24. [DLS]

Dunbar, R. I. M. (1993) Coevolution of neocortical size, group size and language in humans. *Behavioral and Brain Sciences* 11:681–735. [FF]

Dunbar, R. I. M. (1997) *Grooming, gossip, and the evolution of language*. Harvard University Press. [FF]

Eagly, A. H., Kulesa, P., Chen, S. & Chaiken, S. (2001) Do attitudes affect memory? Tests of the congeniality hypothesis. *Current Directions in Psychological Science* 10(1):5–9. Available at: http://cdp.sagepub.com/content/10/1/5.short. [aJBM]

Echterhoff, G., Higgins, T. E., Kopietz, R. & Groll, S. (2008) How communication goals determine when audience tuning biases memory. *Journal of Experimental Psychology: General* 137(1):3–21. Available at: http://psycnet.apa.org/journals/xge/137/1/3/. [aJBM, WH, RAN]

Echterhoff, G., Higgins, E. T. & Levine, J. M. (2009a) Shared reality: Experiencing commonality with others' inner states about the world. *Perspectives on Psychological Science* 4:496–521. [WH]

Echterhoff, G., Hirst, W. & Hussy, W. (2005) How eye-witnesses resist misinformation: Social postwarnings and the monitoring of memory characteristics. *Memory & Cognition* 33(5):770–82. Available at: http://link.springer.com/article/10.3758/BF03193073. [aJBM]

Echterhoff, G., Lang, S., Krämer, N. & Higgins, E. T. (2009b) Audience-tuning effects on memory: The role of audience status in sharing reality. *Social Psychology* 40(3):150–63. Available at: http://econtent.hogrefe.com/doi/abs/10.1027/1864-9335.40.3.150. [aJBM]

Eggins, S. & Slade, D. (1997) *Analysing casual conversation*. Equinox. [J-LD]

Eichenbaum, H. E. & Cohen, N. J. (2014) Can we reconcile the declarative memory and spatial navigation views on hippocampal function? *Neuron* 83:764–70. [DLS]

El Haj, M. (2017) Stereotypes influence destination memory in normal aging. *Experimental Aging Research* 43(4):355–66. Available at: https://doi.org/10.1080/0361073X.2017.1333821. [MEH]

El Haj, M., Allain, P. & Kessels, R. P. (2014) The cognitive and neuroanatomical underpinnings of destination memory. *Translational Neuroscience* 5(2):147–51. [MEH]

El Haj, M., Altman, R., Bortolon, C., Capdevielle, D. & Raffard, S. (2017a) Destination memory in schizophrenia: "Did I told Elvis Presley about the thief?" *Psychiatry Research* 248:71–76. Available at: https://doi.org/10.1016/j.psychres.2016.12.023. [MEH]

El Haj, M., Antoine, P. & Nandrino, J. L. (2017b) When deception influences memory: The implication of theory of mind. *Quarterly Journal of Experimental Psychology* 70(7):1166–73. Available at: https://doi.org/10.1080/17470218.2016.1173079. [MEH]

El Haj, M., Fasotti, L. & Allain, P. (2015a) Destination memory for emotional information in older adults. *Experimental Aging Research* 41(2):204–19. Available at: https://doi.org/10.1080/0361073X.2015.1001658. [MEH]

El Haj, M., Gely-Nargeot, M. C. & Raffard, S. (2015b) Destination memory and cognitive theory of mind in Alzheimer's disease. *Journal of Alzheimer's Disease* 48(2):529–36. Available at: https://doi.org/10.3233/jad-150467. [MEH]

El Haj, M., Kessels, R. P., Matton, C., Bacquet, J. E., Urso, L., Cool, G., Guidez, F., Potier, S., Nandrino, J. L. & Antoine, P. (2016) Destination memory in Korsakoff's syndrome. *Alcoholism, Clinical and Experimental Research* 40(6):1321–27. Available at: https://doi.org/10.1111/acer.13070. [MEH]

El Haj, M. & Miller, R. (2017) Destination memory: The relationship between memory and social cognition. *Psychology Research*. Available at: https://doi.org/10.1007/s00426-017-0891-5, pp. 1–12. (Epub ahead of print). [MEH]

El Haj, M., Omigie, D. & Samson, S. (2015c) Destination memory and familiarity: Better memory for conversations with Elvis Presley than with unknown people. *Aging Clinical and Experimental Research* 27(3):337–44. Available at: https://doi.org/10.1007/s40520-014-0286-z. [MEH]

https://doi.org/10.1017/S0140525X17000012 Published online by Cambridge University Press

El Haj, M., Raffard, S., Antoine, P. & Gely-Nargeot, M. C. (2015d) Emotion and destination memory in Alzheimer's disease. *Current Alzheimer Research* 12 (8):796–801. [MEH]

El Haj, M., Raffard, S. & Gely-Nargeot, M. C. (2016) Destination memory and cognitive theory of mind in normal ageing. *Memory* 24(4):526–34. Available at: https://doi.org/10.1080/09658211.2015.1021257. [MEH]

El Haj, M., Saloppé, X. & Nandrino, J. L. (2017c) Destination memory and deception: When I lie to Barack Obama about the moon. *Psychological Research*. Available at: https://doi.org/10.1007/s00426-016-0840-8. (Epub ahead of print) [MEH]

Epstein, R. & Kanwisher, N. (1998) A cortical representation of the local visual environment. *Nature* 392:598–601. [DCR]

Fabbro, F., Aglioti, S. M., Bergamasco, M., Clarici, A. & Panksepp, J. (2015) Evolutionary aspects of self- and world consciousness in vertebrates. *Frontiers in Human Neuroscience* 9:1–16. [FF]

Fernández, J. (2016) Epistemic generation in memory. *Philosophy and Phenomenological Research* 92(3):620–44. [KM]

Fertuck, E. A., Lenzenweger, M. F., Clarkin, J. F., Hoermann, S. & Stanley, B. (2006a) Executive neurocognition, memory systems, and borderline personality disorder. *Clinical Psychology Review* 26:346–75. [FF]

Fertuck, E. A., Marsano-Jozefowicz, S., Stanley, B., Tryon, W. W., Oquendo, M., Mann, J. J. & Keilp, J. G. (2006b) The impact of borderline personality disorder and anxiety on neuropsychological performance in major depression. *Journal of Personality Disorders* 20:55–70. [FF]

Festinger, L. (1954) A theory of social comparison processes. *Human Relations* 7:117–40. [HB]

Firestone, C. & Scholl, B. J. (2016) Cognition does not affect perception: Evaluating the evidence for so-called "top-down" effects. *Behavioral and Brain Sciences* 39:e229. Available at: https://doi.org/10.1017/S0140525X15000965. Online ahead of publication. [aJBM]

Fischer, S. & Born, J. (2009) Anticipated reward enhances offline learning during sleep. *Journal of Experimental Psychology: Learning, Memory, and Cognition* 35:1586–93. [SD]

Fitzgerald, J. M. & Broadbridge, C. L. (2013) Latent constructs of the autobiographical memory questionnaire: A recollection-belief model of autobiographical experience. *Memory* 21(2):230–48. Available at: http://www.tandfonline.com/doi/abs/10.1080/09658211.2012.725736. [aJBM]

Fivush, R. (2000) Accuracy, authorship and voice: Feminist approaches to autobiographical memory. In: *Towards a feminist developmental psychology,* ed. P. Miller & E. Scholnick, pp. 85–106. Cambridge University Press. [RF]

Fivush, R. (2007) Maternal reminiscing style and children's developing understanding of self and emotion. *Clinical Social Work Journal* 35(1):37–46. [RF]

Fivush, R. (2010a) The development of autobiographical memory. *Annual Review of Psychology* 62(2):2–24. [AC]

Fivush, R. (2010b) Speaking silence: The social construction of voice and silence in cultural and autobiographical narratives. *Memory* 18:88–98. [RF]

Fivush, R. (2013) Religious narratives, identity and well-being in adolescence. In: *Religious voices in self-narratives: Making sense of lives in times of transition*, ed. M. Buitelaar & H. Zock, pp. 105–128. DeGruyter. [RF]

Fivush, R. & Bauer, P. J. (2010) The emergence of recollection: How we learn to recall ourselves in the past. In: *The act of remembering: Toward an understanding of how we recall the past*, ed., J. H. Mace, pp. 259–84. Wiley-Blackwell. [aJBM]

French, L., Garry, M. & Mori, K. (2011) Relative – not absolute – judgments of credibility affect susceptibility to misinformation conveyed during discussion. *Acta Psychologica* 136:119–28. Available at: http://www.sciencedirect.com/science/article/pii/S0001691810002155. [aJBM]

Freud, A. (1937) *The ego and the mechanisms of defense.* Hogarth Press. [FF]

Gabbert, F., Memon, A. & Wright, D. B. (2007) I saw it for longer than you: The relationship between perceived encoding duration and memory conformity. *Acta Psychologica* 124:319–31. Available at: http://www.sciencedirect.com/science/article/pii/S0001691806000515. [aJBM]

Gallistel, C. R. & King, A. P. (2009) *Memory and the computational brain: Why cognitive science will transform neuroscience*. Wiley. [SA]

Gardiner, J. M. (2001) Episodic memory and autonoetic consciousness: A first-person approach. *Philosophical Transactions of the Royal Society B: Biological Sciences* 356:1351–61. Available at: http://rstb.royalsocietypublishing.org/content/356/1413/1351.short. [aJBM]

Gazzaniga, M. S. (2011) *Who's in charge? Free will and the science of the brain*. Harper (Ecco). [FF]

Gilbert, D. T. & Wilson, T. (2007) Prospection: Experiencing the future. *Science* 317:1351–54. [DLS]

Giles, J. W., Gopnik, A. & Heyman, G. D. (2002) Source monitoring reduces the suggestibility of preschool children. *Psychological Science* 13(3):288–91. Available at: http://pss.sagepub.com/content/13/3/288.short. [aJBM]

Godden, D. R. & Baddeley, A. D. (1975) Context-dependent memory in two natural environments: On land and underwater. *British Journal of Psychology* 66 (3):325–31. doi:10.1111/j.2044-8295.1975.tb01468.x. [JMo]

Goethals, G. R. & Reckman, R. F. (1973) The perception of consistency in attitudes. *Journal of Experimental Social Psychology* 9:491–501. Available at: http://www.sciencedirect.com/science/article/pii/0022103173900309. [aJBM]

Goldman, A. I. (1986) *Epistemology and cognition*. Harvard University Press. [MW]

Goldsmith, M., Koriat, A. & Weinberg-Eliezer, A. (2002) Strategic regulation of grain size memory reporting. *Journal of Experimental Psychology: General* 131 (1):73–95. [JN]

Goleman, D. (1985) *Vital lies, simple truths: The psychology of self-deception*. Simon & Schuster. [FF]

Gomes, C. F., Brainerd, C. J. & Stein, L. M. (2013) Effects of emotional valence and arousal on recollective and nonrecollective recall. *Journal of Experimental Psychology: Learning, Memory, and Cognition* 39(3):663–77. [TE]

Gopie, N., Craik, F. I. & Hasher, L. (2010) Destination memory impairment in older people. *Psychology and Aging* 25(4):922–28. https://doi.org/10.1037/a0019703. [MEH]

Gopie, N. & Macleod, C. M. (2009) Destination memory: Stop me if I've told you this before. *Psychological Science* 20(12):1492–99. https://doi.org/10.1111/j.1467-9280.2009.02472.x. [MEH]

Gopnik, A. & Graf, P. (1988) Knowing how you know: Young children's ability to identify and remember the sources of their beliefs. *Child Development* 59 (5):1366–71. Available at: http://www.jstor.org/stable/1130499. [aJBM]

Gottschall, J. (2012) *The storytelling animal: How stories make us human*. Houghton Mifflin Harcourt. [FF]

Gould, S. J. & Lewontin, R. C. (1979) The spandrels of San Marco and the Panglossian paradigm: A critique of the adaptationist programme. *Proceedings of the Royal Society of London B: Biological Sciences* 205(1161):581–98. Available at: https://doi.org/10.1098/rspb.1979.0086. [PR]

Greenberg, D. L., Eacott, M. J., Brechin, D. & Rubin, D. C. (2005) Visual memory loss and autobiographical amnesia: A case study. *Neuropsychologia* 43:1493–502. [DCR]

Greenberg, D. L. & Verfaellie, M. (2010) Interdependence of episodic and semantic memory: Evidence from neuropsychology. *Journal of the International Neuropsychological Society* 16(5):748–53. Available at: https://doi.org/10.1017/S1355617710000676. [BKH]

Greene, E. (1981) Whodunit? Memory for evidence in text. *American Journal of Psychology* 94(3):479–96. Available at: http://www.jstor.org/stable/1422258. [aJBM]

Gross, A. L., Brandt, J., Bandeen-Roche, K., Carlson, M. C., Stuart, E. A., Marsiske, M. & Rebok, G. W. (2014) Do older adults use the method of loci? Results from the ACTIVE study. *Experimental Aging Research* 40(2):140–63. [SA]

Gupta, A. S., van der Meer, M. A. A., Touretzky, D. S. & Redish, A. D. (2010) Hippocampal replay is not a simple function of experience. *Neuron* 65:695–705. Available at: http://www.sciencedirect.com/science/article/pii/S0896627310000607. [aJBM]

Haigh, S. N. & Robinson, E. J. (2009) What children know about the source of their knowledge without reporting it as the source. *European Journal of Developmental Psychology* 6(3):318–36. Available at: http://www.tandfonline.com/doi/full/10.1080/17405620601183569?src=recsys. [arJBM]

Hall, J. D. (2005) The long civil rights movement and the political uses of the past. *The Journal of American History* 91(4):1233–63. [RF]

Hall, L., Johansson, P. & Strandberg, T. (2012) Lifting the veil of morality: Choice blindness and attitude reversals on a self-transforming survey. *PLoS ONE* 7(9):e45457. Available at: https://doi.org/10.1371/journal.pone.0045457. [aJBM]

Hammack, P. L. (2006) Identity, conflict, and coexistence life stories of Israeli and Palestinian adolescents. *Journal of Adolescent Research* 21(4):323–69. [RF]

Hampton, R. R. (2001) Rhesus monkeys know when they remember. *Proceedings of the National Academy of Sciences of the United States of America* 98(9):5359–62. [SS]

Hampton, R. R. (2009) Multiple demonstrations of metacognition in nonhumans: Converging evidence or multiple mechanisms? *Comparative Cognition & Behavior Reviews* 4:17–28. [SS]

Hampton, R. R. & Hampstead, B. M. (2006) Spontaneous behavior of a rhesus monkey (*Macaca mulatta*) during memory tests suggests memory awareness. *Behavioural Processes* 72(2):184–89. [SS]

Han, J. J., Leichtman, M. D. & Wang, Q. (1998) Autobiographical memory in Korean, Chinese, and American children. *Developmental Psychology* 34 (4):701–713. [RF]

Hannula, D. E., Baym, C. L., Warren, D. E. & Cohen, N. J. (2012) The eyes know: Eye movements as a veridical index of memory. *Psychological Science* 23 (3):278–87. Available at: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3917553/. [aJBM]

Hannula, D. E. & Greene, A. J. (2012) The hippocampus reevaluated in unconscious learning and memory: At a tipping point? *Frontiers in Human Neuroscience* 6:80. Available at: http://journal.frontiersin.org/article/10.3389/fnhum.2012.00080/full. [aJBM]

Hannula, D. E. & Ranganath, C. (2008) The eyes have it: Hippocampal activity predicts expression of memory in eye movements. *Neuron* 63:592–99. Available at: https://www.ncbi.nlm.nih.gov/pubmed/19755103. [aJBM]

https://doi.org/10.1017/S0140525X17000012 Published online by Cambridge University Press

Happe, F. & Frith, U. (1996) Theory of mind and social impairment in children with conduct disorder. *British Journal of Developmental Psychology* 14:385–98. [FF]

Hardin, C. D. & Higgins, E. T. (1996) Shared reality: How social verification makes the subjective objective. In: *Handbook of motivation and cognition: The interpersonal context, vol. 3*, ed. R. M. Sorrentino & E. T Higgins, pp. 28–84. Guilford Press. [AC]

Harris, C. B., Rasmussen, A. S. & Berntsen, D. (2014) The functions of autobiographical memory: An integrative approach. *Memory* 22(5):559–81. [DB, DCR, rJBM]

Harris, F. C. (2006) It takes a tragedy to arouse them: Collective memory and collective action during the civil rights movement. *Social Movement Studies* 5 (1):19–43. [AC]

Hassabis, D., Kumaran, D. & Maguire, E. A. (2007a) Using imagination to understand the neural basis of episodic memory. *The Journal of Neuroscience* 27 (52):14365–74. Available at: https://doi.org/10.1523/JNEUROSCI.4549-07.2007. [aJBM, RGB, JH]

Hassabis, D., Kumaran, D., Vann, S. D. & Maguire, E. A. (2007b) Patients with hippocampal amnesia cannot imagine new experiences. *Proceedings of the National Academy of Sciences USA* 104(5):1726–31. Available at: https://doi.org/10.1073/pnas.0610561104. [aJBM, RGB, JH, DCR]

Hassabis, D. & Maguire, E. A. (2007) Deconstructing episodic memory with construction. *Trends in Cognitive Sciences* 11(7):299–306. Available at: http://www.sciencedirect.com/science/article/pii/S1364661307001258. [aJBM]

Hassabis, D. & Maguire, E. A. (2009) The construction system of the brain. *Philosophical Transactions of the Royal Society B: Biological Sciences* 364 (1521):1263–271. Available at: http://rstb.royalsocietypublishing.org/content/364/1521/1263.short. [aJBM, FF]

Haun, D. & Tomasello, M. (2011) Conformity to peer pressure in preschool children. *Child Development* 82:1759–67. [FF]

Hayne, H. & Jack, F. (2011) Childhood amnesia. *WIREs Cognitive Science* 2:136–45. Available at: http://onlinelibrary.wiley.com/doi/10.1002/wcs.107/abstract. [aJBM]

Healey, M. K. & Kahana, M. J. (2014) Is memory search governed by universal principles or idiosyncratic strategies? *Journal of Experimental Psychology: General* 143(2):575–96. [SA]

Hegdé, J. (2007) Mental time travel sickness and a Bayesian remedy. *Brain and Behavioral Sciences* 30:323–24. [BKH]

Hemmer, P. & Steyvers, M. (2009) A Bayesian account of reconstructive memory. *Topics in Cognitive Science* 1:189–202. Available at: http://onlinelibrary.wiley.com/doi/10.1111/j.1756-8765.2008.01010.x/full. [aJBM]

Henke, K. (2010) A model for memory systems based on processing modes rather than consciousness. *Nature Reviews Neuroscience* 11(7):523–32. Available at: https://www.ncbi.nlm.nih.gov/pubmed/20531422. [aJBM]

Henkel, L. A. & Mather, M. (2007) Memory attributions for choices: How beliefs shape our memories. *Journal of Memory and Language* 57(2):163–76. Available at: http://www.sciencedirect.com/science/article/pii/S0749596X06001185. [aJBM]

Higgins, E. T. & Rholes, W. S. (1978) "Saying is believing": Effects of message modification on memory and liking for the person described. *Journal of Experimental Social Psychology* 14:363–78. Available at: http://www.sciencedirect.com/science/article/pii/002210317890032X. [aJBM]

Hills, T. T. & Butterfill, S. (2015) From foraging to autonoetic consciousness: The primal self as a consequence of embodied prospective foraging. *Current Zoology* 61(2):368–81. Available at: http://cz.oxfordjournals.org/content/61/2/368.abstract. [aJBM]

Hintzman, D. L. (2004) Judgment frequency versus recognition confidence: Repetition and recursive reminding. *Memory & Cognition* 32:336–50. [KKS]

Hirst, W. (2014) The (social) context of memory. In: *Contextualizing human memory: An interdisciplinary approach to understanding how individuals and groups remember the past*, ed. C. B. Stone & L. M. Bietti, pp. 209–16. Routledge. [WH]

Hirst, W. & Echterhoff, G. (2012) Remembering in conversations: The social sharing and reshaping of memories. *Annual Review of Psychology* 63:55–79. [WH]

Hoerl, C. & McCormack, T. (2016) Making decisions about the future: Regret and the cognitive function of episodic memory. In: *Seeing the future: Theoretical perspectives on future-oriented mental time travel*, ed. K. Michaelian, S. B. Klein & K. Szpunar, pp. 241–66. Oxford University Press. [rJBM]

Hofstadter, D. (1982) *Metamagical themas: Questing for the essence of mind and pattern.* Basic Books. [FDB]

Holmqvist, R. (2008) Psychopathy and affect consciousness in young criminal offenders. *Journal of Interpersonal Violence* 23:209–24. [FF]

Hornstein, S. L. & Mulligan, N. W. (2004) Memory for actions: Enactment and source memory. *Psychonomic Bulletin and Review* 11(2):367–72. [MEH]

Howe, M. L. (2011) The adaptive nature of memory and its illusions. *Current Directions in Psychological Science* 20:312–15. [RAN]

Hunt, R. R. (2006) The concept of distinctiveness in memory research. In: *Distinctiveness and memory*, ed. R. R. Hunt & J. B. Worthen, pp. 3–46. Oxford University Press. [DB]

Huntjens, R. J., Peters, M. L., Woertman, L., van der Hart, O. & Postma, A. (2007) Memory transfer for emotionally valenced words between identities in dissociative identity disorder. *Behaviour Research and Therapy* 45(4):775–89. Available at: https://doi.org/10.1016/j.brat.2006.07.001. [JMo]

Huntjens, R. J., Postma, A., Peters, M. L., Woertman, L. & van der Hart, O. (2003) Interidentity amnesia for neutral, episodic information in dissociative identity disorder. *Journal of Abnormal Psychology* 112(2):290–97. Available at: https://doi.org/10.1037/0021-843X.112.2.290. [JMo]

Huntjens, R. J. C., Verschuere, B. & McNally, R. J. (2012) Inter-identity autobiographical amnesia in patients with dissociative identity disorder. *PLoS ONE* 7, e40580. Available at: https://doi.org/10.1371/journal.pone.0040580. [JMo]

Hurley, N. C., Maguire, E. A. & Vargha-Khadem, F. (2011) Patient HC with developmental amnesia can construct future scenarios. *Neuropsychologia* 49 (13):3620–28. [JH]

Hyman, I. E., Jr., Husband, T. H. & Billings, F. J. (1995) False memories of childhood experiences. *Applied Cognitive Psychology* 9:181–97. [HB]

Iñiguez, G., Govezensky, T., Dunbar, R., Kaski, K. & Barrio, R. A. (2014) Effects of deception in social networks. *Proceedings of the Royal Society B: Biological Sciences* 281:1–9. [FF]

Inostroza, M., Binder, S. & Born, J. (2013) Sleep-dependency of episodic-like memory consolidation in rats. *Behavioural Brain Research* 237:15–22. [SD]

Irish, M., Addis, D. R., Hodges, J. R. & Piguet, O. (2012a) Considering the role of semantic memory in episodic future thinking: Evidence from semantic dementia. *Brain* 135(Pt 7):2178–91. Available at: https://doi.org/10.1093/brain/aws119. [arJBM, BKH]

Irish, M., Addis, D. R., Hodges, J. R. & Piguet, O. (2012b) Exploring the content and quality of episodic future simulations in semantic dementia. *Neuropsychologia* 50(14):3488–95. Available at: https://doi.org/10.1016/j.neuropsychologia.2012.09.012. [BKH]

Irish, M., Eyre, N., Dermody, N., O'Callaghan, C., Hodges, J. R., Hornberger, M. & Piguet, O. (2016) Neural substrates of semantic prospection – Evidence from the dementias. *Frontiers in Behavioral Neuroscience* 10:96. Available at: https://doi.org/10.3389/fnbeh.2016.00096. [BKH]

Irish, M. & Piguet, O. (2013) The pivotal role of semantic memory in remembering the past and imagining the future. *Frontiers in Behavioral Neuroscience* 7:27. Available at: https://doi.org/10.3389/fnbeh.2013.00027. [BKH]

Irish, M. & Piolino, P. (2016) Impaired capacity for prospection in the dementias – Theoretical and clinical implications. *British Journal of Clinical Psychology* 55 (1):49–68. Available at: https://doi.org/10.1111/bjc.12090. [BKH]

Jaeger, A., Lauris, P., Selmeczy, D. & Dobbins, I. G. (2012) The costs and benefits of memory conformity. *Memory & Cognition* 40:101–12. Available at: http://link.springer.com/article/10.3758/s13421-011-0130-z. [aJBM]

Jerison, H. J. (1973) *Evolution of the brain and intelligence.* Academic Press. [FF]

Jerison, H. J. (2002) Evolution of the brain. In: *Encyclopedia of the human brain, vol. 2*, ed. V. S. Ramachandran, pp. 251–67. Academic Press. [FF]

Jiang, W., Liu, H., Liao, J., Ma, X., Rong, P., Tang, Y. & Wang, W. (2013) A functional MRI study of deception among offenders with antisocial personality disorders. *Neuroscience* 244:90–98. [FF]

Johansson, P., Hall, L., Sikström, S. & Olsson, A. (2005) Failure to detect mismatches between intention and outcome in a simple decision task. *Science* 310:116–19. Available at: http://science.sciencemag.org/content/310/5745/116. [aJBM]

Johnson, M. K. (1988) Reality monitoring: An experimental phenomenological approach. *Journal of Experimental Psychology: General* 117:390–94. [HB]

Johnson, M. K. (1991) Reality monitoring: Evidence from confabulation in organic brain disease patients. In: *Awareness of deficit after brain injury: Clinical and theoretical issues*, ed. G. P. Prigatano & D. L. Schacter, pp. 176–97. Oxford University Press. [aJBM]

Johnson, M. K. (2005) The relation between source memory and episodic memory: Comment on Siedlicki et al. (2005). *Psychology and Aging* 20(3):529–31. Available at: http://psycnet.apa.org/journals/pag/20/3/529/. [aJBM]

Johnson, M. K., Bush, J. G. & Mitchell, K. J. (1998) Interpersonal reality monitoring: Judging the sources of other people's memories. *Social Cognition* 16(2):199–224. [aJBM]

Johnson, M. K., Hashtroudi, S. & Lindsay, D. S. (1993) Source monitoring. *Psychological Bulletin* 114(1):3–28. Available at: http://psycnet.apa.org/journals/bul/114/1/3/. [arJBM, HB, RAN, DLS]

Johnson, M. K., Kuhl, B. A., Mitchell, K. J., Ankudowich, E. & Durbin, K. A. (2015) Age-related differences in the neural basis of the subjective vividness of memories: Evidence from multivoxel pattern classification. *Cognitive, Affective and Behavioral Neuroscience* 15:644–61. [DCR]

Johnson, M. K. & Raye, C. L. (1981) Reality monitoring. *Psychological Review* 88 (1):67–85. Available at: http://psycnet.apa.org/journals/rev/88/1/67/. [aJBM]

Johnson, M. K. & Raye, C. L. (1998) False memories and confabulation. *Trends in Cognitive Sciences* 2(4):137–45. Available at: http://www.sciencedirect.com/science/article/pii/S1364661398011528. [aJBM]

Johnson, M. K. & Suengas, A. G. (1989) Reality monitoring judgments of other people's memories. *Bulletin of the Psychonomic Society* 27(2):107–110. Available at: http://link.springer.com/article/10.3758/BF03329910. [aJBM]

https://doi.org/10.1017/S0140525X17000012 Published online by Cambridge University Press

Kahneman, D. (2011) *Thinking, fast and slow.* Farrar, Straus and Giroux. [FF]
Kameda, T., Ohtsubo, Y. & Takezawa, M. (1997) Centrality in sociocognitive networks and social influence: An illustration in a group decision-making context. *Journal of Personality and Social Psychology* 73(2):296–309. [AC]
Kappes, A. & Crockett, M. J. (2016) The benefits and costs of a rose-colored hindsight. *Trends in Cognitive Sciences* 20(9):644–46. Available at: http://www.sciencedirect.com/science/article/pii/S1364661316300808. [aJBM]
Keven, N. (2016a) A story to remember: Narrativity, memory and the self. Unpublished doctoral dissertation. Washington University, St. Louis, MO. [JH]
Keven, N. (2016b) Events, narratives and memory. *Synthese* 193(8):2497–517. Available at: http://link.springer.com/article/10.1007/s11229-015-0862-6. [aJBM, NK]
Király, I., Oláh, K., Kovács, A. & Csibra, G. (in preparation) *The time-course of belief computation: Can 18- and 36-month-olds revise attributed mental states by episodic recomputation?* [aJBM, DK]
Kirmayer, L. J., Brass, G. M. & Tait, C. L. (2000) The mental health of Aboriginal peoples: Transformations of identity and community. *The Canadian Journal of Psychiatry* 45(7):607–16. [RF]
Klein, S. B. (2013a) The complex act of projecting oneself into the future. *WIREs Cognitive Science* 4:63–79. Available at: http://onlinelibrary.wiley.com/doi/10.1002/wcs.1210/full. [aJBM]
Klein, S. B. (2013b) Making the case that episodic recollection is attributable to operations occurring at retrieval rather than to content stored in a dedicated subsystem of long-term memory. *Frontiers in Behavioral Neuroscience* 7:1–14. Available at: http://journal.frontiersin.org/article/10.3389/fnbeh.2013.00003/full. [arJBM]
Klein, S. B. (2013c) The temporal orientation of memory: It's time for a change in direction. *Journal of Applied Research in Memory and Cognition* 2:222–34. [KKS]
Klein, S. B. (2014) Autonoesis and belief in a personal past: An evolutionary theory of memory indices. *Review of Philosophy and Psychology* 5:417–47. Available at: http://link.springer.com/article/10.1007/s13164-014-0181-8. [aJBM]
Klein, S. B. (2015a) The feeling of personal ownership of one's mental states: A conceptual argument and empirical evidence for an essential, but underappreciated, mechanism of mind. *Psychology of Consciousness: Theory, Research, and Practice* 2(4):355–76. [JN]
Klein, S. B. (2015b) What memory is. *WIRES Cognitive Science* 6(1):1–38. Available at: http://onlinelibrary.wiley.com/doi/10.1002/wcs.1333/full. [aJBM]
Klein, S. B., Cosmides, L., Gangi, C. E., Jackson, B., Tooby, J. & Costable, K. A. (2009) Evolution and episodic memory: An analysis and demonstration of a social function of episodic recollection. *Social Cognition* 27(2):283–319. [aJBM, JR]
Klein, S. B., Cosmides, L., Tooby, J. & Chance, S. (2002a) Decisions and the evolution of memory: Multiple systems, multiple functions. *Psychological Review* 109(2):306–29. Available at: https://www.ncbi.nlm.nih.gov/pubmed/11990320. [aJBM]
Klein, S. B. & Gangi, C. E. (2010) The multiplicity of self: Neuropsychological evidence and its implications for the self as a construct in psychological research. *Annals of the New York Academy of Sciences* 1191:1–15. Available at: http://onlinelibrary.wiley.com/doi/10.1111/j.1749-6632.2010.05441.x/full. [aJBM, KKS]
Klein, S. B., German, T. B., Cosmides, L. & Gabriel, R. (2004) A theory of autobiographical memory: Necessary components and disorders resulting from their loss. *Social Cognition* 22(5):460–90. [aJBM]
Klein, S. B., Loftus, E. & Kihlstrom, J. F. (1996) Self-knowledge of an amnesic patient: Toward a neuropsychology of personality and social psychology. *Journal of Experimental Psychology: General* 125(3):250–60. Available at: https://www.ncbi.nlm.nih.gov/pubmed/8751820. [aJBM]
Klein, S. B., Loftus, J. & Kihlstrom, J. F. (2002b) Memory and temporal experience: The effects of episodic memory loss on an amnesic patient's ability to remember the past and imagine the future. *Social Cognition* 20(5):353–79. Available at: https://doi.org/10.1521/soco.20.5.353.21125. [aJBM, RGB, BKH]
Klein, S. B. & Markowitsch, H. J. (2015) The nature of the semantic/episodic distinction: A missing piece of the "working through" process. *Behavioral and Brain Sciences* 38:e9. Available at: http://www.ncbi.nlm.nih.gov/pubmed/26050700. [aJBM]
Klein, S. B. & Nichols, S. (2012) Memory and the sense of personal identity. *Mind* 121(483):677–702. Available at: http://mind.oxfordjournals.org/content/early/2012/10/30/mind.fzs080.short. [arJBM]
Kopietz, R., Echterhoff, G., Niemeier, S., Hellmann, J. H. & Memon, A. (2009) Audience-congruent biases in eyewitness memory and judgment: Influences of a co-witness' liking for a suspect. *Social Psychology* 40(3):138–49. Available at: http://econtent.hogrefe.com/doi/abs/10.1027/1864-9335.40.3.138. [aJBM]
Koppel, J., Wohl, D., Meksin, R. & Hirst, W. (2014) The effects of listening to others remember on subsequent memory: The role of expertise and trust in socially shared retrieval-induced forgetting. *Social Cognition* 32:148–80. [AC]
Koriat, A. (2008) Subjective confidence in one's answers: The consensuality principle. *Journal of Experimental Psychology: Learning, Memory, and Cognition* 34 (4):945–59. [JN]
Koriat, A. & Adiv, S. (2016) The self-consistency theory of subjective confidence. In: *The Oxford handbook of metamemory*, ed. J. Dunlosky & S. Tauber, pp. 127–47. Oxford University Press. [rJBM]
Koriat, A., Ben-Zur, H. & Druch, A. (1991) The contextualization of input and output events in memory. *Psychological Research* 53(3):260–70. [MEH]
Koriat, A., Ben-Zur, H. & Sheffer, D. (1988) Telling the same story twice: Output monitoring and age. *Journal of Memory and Language* 27(1):23–39. [MEH]
Koriat, A. & Goldsmith, M. (1996a) Memory metaphors and the real-life/laboratory controversy: Correspondence versus storehouse conceptions of memory. *Behavioral and Brain Sciences* 19:167–228. Available at: https://www.cambridge.org/core/journals/behavioral-and-brain-sciences/article/memory-metaphors-and-the-real-lifelaboratory-controversy-correspondence-versus-storehouse-conceptions-of-memory/5C2A5F74C9D820A4FEB516DAA1E2E358. [aJBM]
Koriat, A. & Goldsmith, M. (1996b) Monitoring and control processes in the strategic regulation of memory accuracy. *Psychological Review* 103:490–517. [RAN]
Kornblith, H. (2012) *On reflection*. Oxford University Press. [aJBM]
Kornell, N., Son, L. K. & Terrace, H. S. (2007) Transfer of metacognitive skills and hint seeking in monkeys. *Psychological Science* 18(1):64–71. [SS]
Kouchaki, M. & Gino, F. (2016) Memories of unethical actions become obfuscated over time. *Proceedings of the National Academy of Sciences USA* 113(22):6166–71. Available at: http://www.pnas.org/content/113/22/6166.short. [aJBM, FF]
Krauel, K., Duezel, E., Hinrichs, H., Santel, S., Rellum, T. & Baving, L. (2007) Impact of emotional salience on episodic memory in attention-deficit/hyperactivity disorder: A functional magnetic resonance imaging study. *Biological Psychiatry* 61:1370–79. [FF]
Kraut, R. E. (1978) Verbal and nonverbal cues in the perception of lying. *Journal of Personality and Social Psychology* 36(4):380–91. Available at: http://psycnet.apa.org/journals/psp/36/4/380/. [aJBM]
Krebs, J. R. & Dawkins, R. (1984) Animal signals: Mind-reading and manipulation. In: *Behavioral ecology: An evolutionary approach*, 2nd edition, ed. J. R. Krebs & N. B. Davies, pp. 380–402. Blackwell Science. [aJBM]
Kulkofsky, S., Wang, Q. & Koh, J. B. K. (2009) Functions of memory sharing and mother-child reminiscing behaviors: Individual and cultural variations. *Journal of Cognition and Development* 10(1-2):92–114. [RF]
Kumaran, D., Banino, A., Blundell, C., Hassabis, D. & Dayan, P. (2016) Computations underlying social hierarchy learning: Distinct mechanisms for updating and representing self-relevant information. *Neuron* 76:653–66. [RAM]
Kurzban, R. (2012) *Why everyone (else) is a hypocrite: Evolution and the modular mind*. Princeton University Press. [rJBM]
Kwan, D., Carson, N., Addis, D. R. & Rosenbaum, R. S. (2010) Deficits in past remembering extend to future imagining in a case of developmental amnesia. *Neuropsychologia* 48(11):3179–86. [JR]
Kwan, D., Craver, C. F., Green, L., Myerson, J., Boyer, P. & Rosenbaum, R. S. (2012) Future decision-making without episodic mental time travel. *Hippocampus* 22(6):1215–19. Available at: https://doi.org/10.1002/hipo.20981. [aJBM, RGB, KKS]
Kwan, D., Craver, C. F., Green, L., Myerson, J., Gao, F., Black, S. E. & Rosenbaum, R. S. (2015) Cueing the personal future to reduce discounting in intertemporal choice: Is episodic prospection necessary? *Hippocampus* 25(4):432–43. Available at: https://doi.org/10.1002/hipo.22431. [RGB, KKS]
Kwan, D., Craver, C. F., Green, L., Myerson, J. & Rosenbaum, R. S. (2013) Dissociations in future thinking following hippocampal damage: Evidence from discounting and time perspective in episodic amnesia. *Journal of Experimental Psychology. General* 142(4):1355–69. Available at: https://doi.org/10.1037/a0034001. [RGB]
Kwong See, S. T., Wood. T. L. & Hoffman, H. G. (2001) Perceptions of an old female eyewitness: Is the older eyewitness believable? *Psychology and Aging* 16(2):346–50. Available at: http://psycnet.apa.org/journals/pag/16/2/346/. [aJBM]
Laible, D. & Song, J. (2006) Constructing emotional and relational understanding: The role of affect and mother-child discourse. *Merrill-Palmer Quarterly* 52 (1):44–69. [RF]
Lambon Ralph, M. A., Sage, K., Jones, R. W. & Mayberry, E. J. (2010) Coherent concepts are computed in the anterior temporal lobes. *Proceedings of the National Academy of Sciences USA* 107(6):2717–22. Available at: https://doi.org/10.1073/pnas.0907307107. [BKH]
Lampinen, J. M., Neuschatz, J. S. & Payne, D. G. (1997) Memory illusions and consciousness: Examining the phenomenology of true and false memories. *Current Psychology* 16(3):181–224. Available at: http://link.springer.com/article/10.1007/s12144-997-1000-5. [aJBM]
Lampinen, J. M. & Smith, V. L. (1995) The incredible (and sometimes incredulous) child witness: Child eyewitnesses' sensitivity to source credibility cues. *Journal of Applied Psychology* 80(5):621–27. Available at: http://psycnet.apa.org/journals/apl/80/5/621/. [aJBM]
Lane, R., Ryan, L., Nadel, L. & Greenberg, L. (2015) Memory reconsolidation, emotional arousal, and the process of change in psychotherapy: New insights from brain science. *Behavioral and Brain Sciences* 38:1–64. [DCR]

https://doi.org/10.1017/S0140525X17000012 Published online by Cambridge University Press

Lebreton, M., Bertoux, M., Boutet, C., Lehericy, S., Dubois, B., Fossati, P. & Pessiglione, M. (2013) A critical role for the hippocampus in the valuation of imagined outcomes. *PLoS Biology* 11(10):e1001684. Available at: https://doi.org/10.1371/journal.pbio.1001684. [RGB]

Leding, J. K. (2012) False memories and persuasion strategies. *Review of General Psychology* 16(3):256–68. Available at: http://psycnet.apa.org/journals/gpr/16/3/256/. [aJBM, RAN]

Lee, R. B. & Daly, R. H. (1999) *The Cambridge encyclopedia of hunters and gatherers*. Cambridge University Press. [FF]

Levine, L. J. (1997) Reconstructing memory for emotions. *Journal of Experimental Psychology: General* 126(2):165–77. Available at: http://psycnet.apa.org/journals/xge/126/2/165/. [aJBM]

Lewis, A., Call, J. & Berntsen, D. (2017) Non-goal-directed recall of specific events in apes after long delays. *Proceedings of the Royal Society B: Biological Sciences* 284: 20170518. [DB]

Lewis, P. A. & Durrant, S. J. (2011) Overlapping memory replay during sleep builds cognitive schemata. *Trends in Cognitive Science* 15:343–51. [SD]

Lindsay, D. S. (2008) Source monitoring. In: Cognitive psychology of memory, ed. H. L. Roediger, III, pp. 325–48. Elsevier. [HB]

Lindsay, D. S. & Johnson, M. K. (1989) The eyewitness suggestibility effect and memory for source. *Memory & Cognition* 17(3):349–58. Available at: http://link.springer.com/article/10.3758/BF03198473. [aJBM]

Liu, L., Feng, T., Chen, J. & Li, H. (2013) The value of emotion: How does episodic prospection modulate delay discounting? *PLoS ONE* 8(11):e81717. Available at: https://doi.org/10.1371/journal.pone.0081717. [RGB]

Loftus, E. (1977) Shifting human color memory. *Memory & Cognition* 5(6):696–99. Available at: http://link.springer.com/article/10.3758/BF03197418. [aJBM]

Loftus, E. (2005) Planting misinformation in the human mind: A 30-year investigation of the malleability of memory. *Learning & Memory* 12(4):361–66. Available at: http://learnmem.cshlp.org/content/12/4/361.short. [arJBM]

Loftus, E. F. & Pickrell, J. E. (1995) The formation of false memories. *Psychiatric Annals* 25:720–25. [rJBM, SR]

Lonigro, A., Laghi, F., Baiocco, R. & Baumgartner, E. (2014) Mind reading skills and empathy: Evidence for nice and nasty ToM behaviours in school-aged children. *Journal of Child and Family Studies* 23:581–90. [FF]

Ludmer, R., Edelson, M. G. & Dudai, Y. (2015) The naïve and the distrustful: State dependency of hippocampal computations in manipulative memory distortion. *Hippocampus* 25:240–52. Available at: http://onlinelibrary.wiley.com/doi/10.1002/hipo.22369/full. [aJBM]

Luria, A. R. (1987) *The mind of a mnemonist: A little book about a vast memory*, trans. L. Solotaroff. Harvard University Press. [SA]

Lutz, N., Diekelmann, S., Hinse-Stern, P., Born, J. & Rauss, K. (2017) Sleep supports the slow abstraction of gist from visual perceptual memories. *Scientific Reports* 7:42950. [SD]

Maguire, E. A., Intraub, H. & Mullally, S. L. (2015) Scenes, spaces and memory traces: What does the hippocampus do? *The Neuroscientist* 22(5):432–39. Available at: https://doi.org/10.1177/1073858415600389.. [aJBM]

Maguire, E. A. & Mullally, S. L. (2013) The hippocampus: A manifesto for change. *Journal of Experimental Psychology: General* 142(4):1180–89. Available at: http://psycnet.apa.org/psycinfo/2013-25332-001. [aJBM, DCR]

Maguire, E. A., Vargha-Khadem, F. & Hassabis, D. (2010) Imagining fictitious experiences: Evidence from developmental amnesia. *Neuropsychologia* 48:3187–92. Available at: http://www.sciencedirect.com/science/article/pii/S0028393210002885. [aJBM]

Marsh, E. J. (2007) Retelling is not the same as recalling. *Current Directions in Psychological Science* 16(1):16–20. Available at: http://cdp.sagepub.com/content/16/1/16.short. [aJBM]

Martin-Ordas, G., Berntsen, D. & Call, J. (2013) Memory for distant past events in chimpanzees and orangutans. *Current Biology* 23:1438–41. Available at: http://www.sciencedirect.com/science/article/pii/S0960982213007082. [aJBM, DB]

Martin-Ordas, G., Haun, D., Colmenares, F. & Call, J. (2010) Keeping track of time: Evidence for episodic-like memory in great apes. *Animal Cognition* 13:331–40. Available at: http://link.springer.com/article/10.1007/s10071-009-0282-4. [aJBM]

Mascaro, O. & Sperber, D. (2009) The moral, epistemic, and mindreading components of children's vigilance towards deception. *Cognition* 112:367–80. Available at: http://www.sciencedirect.com/science/article/pii/S0010027709001152. [aJBM]

Mather, M. & Johnson, M. K. (2000) Choice-supportive source monitoring: Do our decisions seem better to us as we age? *Psychology and Aging* 15(4):596–606. Available at: http://psycnet.apa.org/journals/pag/15/4/596/. [aJBM]

Mather, M., Shafir, E. & Johnson, M. K. (2000) Misremembrance of options past: Source monitoring and choice. *Psychological Science* 11(2):132–38. Available at: http://pss.sagepub.com/content/11/2/132.short. [aJBM]

Mather, M., Shafir, E. & Johnson, M. K. (2003) Remembering chosen and assigned options. *Memory & Cognition* 31(3):422–33. Available at: http://link.springer.com/article/10.3758/BF03194400. [aJBM]

Matthen, M. (2010) Is memory preservation? *Philosophical Studies* 148:3–14. Available at: http://link.springer.com/article/10.1007/s11098-010-9501-8. [aJBM]

Mazzoni, G. & Kirsch, I. (2002) Autobiographical memories and beliefs: A preliminary metacognitive model. In: *Applied metacognition*, ed. T. J. Perfect & B. L. Schwartz, pp. 121–45. Cambridge University Press. [aJBM]

Mazzoni, G., Scoboria, A. & Harvey, L. (2010) Nonbelieved memories. *Psychological Science;* 21:1334–40. [HB, RAN]

McAdams, D. P. (2006) *The redemptive self: Stories Americans live by*. Oxford University Press. [DCR]

McAdams, D. P. (2013) The psychological self as actor, agent, and author. *Perspectives on Psychological Science* 8:272–95. [DCR]

McCormack, T. & Hoerl, C. (2011) Tool use, planning and future thinking in children and animals. In: *Tool use and causal cognition*, ed. T. McCormack, C. Hoerl & S. Butterfill, p. 129. Oxford University Press. [NK]

McDermott, K. B., Szpunar, K. K. & Christ, S. E. (2009) Laboratory based and autobiographical retrieval tasks differ substantially in their neural substrates. *Neuropsychologia* 47:2290–98. [DCR]

McFarlane, A. C. & Bookless, C. (2001) The effect of PTSD on interpersonal relationships: Issues for emergency service workers. *Sexual and Relationship Therapy* 16(3):261–67. [TE]

McKoon, G. & Ratcliff, R. (1979) Priming in episodic and semantic memory. *Journal of Verbal Learning and Verbal Behavior* 18:463–80. [DCR]

McLean, K. C. & Syed, M. (2015) Personal, master, and alternative narratives: An integrative framework for understanding identity development in context. *Human Development* 58(6):318–49. [RF]

McLaughlin, B. P. (2009) Systematicity redux. *Synthese* 170:251–74. Available at: https://doi.org/10.1007/s11229-009-9582-0. [MW]

McMyler, B. (2007) Knowledge at second hand. *Inquiry* 50(5):511–40. Available at: http://www.tandfonline.com/doi/abs/10.1080/00201740701612390. [aJBM]

Mercier, H. (2016) The argumentative theory: Predictions and empirical evidence. *Trends in Cognitive Sciences* 20(9):689–700. Available at: http://www.sciencedirect.com/science/article/pii/S1364661316300973. [aJBM]

Mercier, H. & Sperber, D. (2011) Why do humans reason? Arguments for an argumentative theory. *Behavioral and Brain Sciences* 34(2):57–74. Available at: https://www.cambridge.org/core/journals/behavioral-and-brain-sciences/article/why-do-humans-reason-arguments-for-an-argumentative-theory/53E3F3180014E80E8BE9FB7A2DD44049. [aJBM]

Mercier, H. & Sperber, D. (2017) *The enigma of reason*. Harvard University Press. [arJBM]

Merckelbach, H., Jelicic, M. & Pieters, M. (2010) The residual effect of feigning: How intentional faking may evolve into a less conscious form of symptom reporting. *Journal of Experimental and Clinical Neuropsychology* 33(1):131–39. Available at: http://www.tandfonline.com/doi/abs/10.1080/13803395.2010.495055. [aJBM]

Merckelbach, H., Jelicic, M. & Pieters, M. (2011) Misinformation increase symptom reporting: A test-retest study. *Journal of the Royal Society of Medicine Short Reports* 2(75):1–6. Available at: http://shr.sagepub.com/content/2/10/75.short. [aJBM]

Metzinger, T. (2004) *Being no one: The self-model theory of subjectivity*. MIT Press. [JN]

Michael, J., Sebanz, N. & Knoblich G. (2016a) Observing joint action: Coordination creates commitment. *Cognition* 157:106–13. [JMi]

Michael, J., Sebanz, N. & Knoblich, K. (2016b) The sense of commitment: A minimal approach. *Frontiers in Psychology* 6:1968. doi:10.3389/fpsyg.2015.01968. [JMi]

Michaelian, K. (2011a) Generative memory. *Philosophical Psychology* 24(3):323–42. Available at: http://www.tandfonline.com/doi/abs/10.1080/09515089.2011.559623. [aJBM]

Michaelian, K. (2011b) Is memory a natural kind? *Memory Studies* 4(2):170–89. [rJBM]

Michaelian, K. (2012a) Metacognition and endorsement. *Mind & Language* 27(3):284–307. Available at: http://onlinelibrary.wiley.com/doi/10.1111/j.1468-0017.2012.01445.x/full. [aJBM]

Michaelian, K. (2012b) (Social) metacognition and (self-)trust. *Review of Philosophy and Psychology* 3:481–514. Available at: http://link.springer.com/article/10.1007/s13164-012-0099-y. [aJBM]

Michaelian, K. (2013) The information effect: Constructive memory, testimony, and epistemic luck. *Synthese* 190(12):2429–56. [KM]

Michaelian, K. (2015) Opening the doors of memory: Is declarative memory a natural kind? *WIRES Cognitive Science* 6:475–82. Available at: http://onlinelibrary.wiley.com/doi/10.1002/wcs.1364/full. [aJBM]

Michaelian, K. (2016a) Confabulating, misremembering, relearning: The simulation theory of memory and unsuccessful remembering. *Frontiers in Psychology* 7:1857. doi:10.3389/fpsyg.2016.01857. [aJBM, SR]

Michaelian, K. (2016b) *Mental time travel: Episodic memory and our knowledge of the personal past*. MIT Press. [arJBM, FF, KM]

Millikan, R. G. (1984) *Language, thought and other biological categories: New foundations for realism*. MIT Press. [aJBM]

https://doi.org/10.1017/S0140525X17000012 Published online by Cambridge University Press

Mitchell, K. & Johnson, M. (2000) Source monitoring: Attributing mental experiences. In: *The Oxford handbook of memory*, ed. E. Tulving & F. Craik, pp. 179–95. Oxford University Press. [PC]

Morgan, G., Kornell, N., Kornblum, T. & Terrace, H. S. (2014) Retrospective and prospective metacognitive judgments in rhesus macaques (*Macaca mulatta*). *Animal Cognition* 17(2):249–57. [SS]

Morton, J. (2012) Memory and the dissociative brain. In: *Trauma, dissociation and multiplicity*, ed. V. Sinason, pp. 65–78. Routledge. [JMo]

Morton, J. (2017) Interidentity amnesia in dissociative identity disorder. *Cognitive Neuropsychiatry* 22(4):315–30. Available at: https://doi.org/10.1080/13546805.2017.1327848. [JMo]

Moscovitch, M. (2008) The hippocampus as a "stupid," domain-specific module: Implications for theories of recent and remote memory, and of imagination. *Canadian Journal of Experimental Psychology* 62(1):62–79. Available at: http://psycnet.apa.org/index.cfm?fa=buy.optionToBuy&uid=2008-05131-008. [aJBM]

Moser, E. I., Kropff, E. & Moser, M. (2008) Place cells, grid cells and the brain's spatial representation system. *Annual Review of Neuroscience* 31:69–89. Available at: http://www.annualreviews.org/eprint/7t2VcSrTYa8V8yACMweG/full/10.1146/annurev.neuro.31.061307.090723?select23=Choose&&. [aJBM]

Mullally, S. L., Hassabis, D. & Maguire, E. A. (2012) Scene construction in amnesia: An fMRI study. *Journal of Neuroscience* 32(16):5646–53. [JH]

Mullally, S. L. & Maguire, E. A. (2013) Exploring the role of space defining objects in constructing and maintaining imagine scenes. *Brain and Cognition* 82:100–107. [DCR]

Mullally, S. L. & Maguire, E. A. (2014) Learning to remember: The early ontogeny of episodic memory. *Developmental Cognitive Neuroscience* 9:12–29. Available at: http://www.sciencedirect.com/science/article/pii/S1878929314000024. [aJBM]

Müller-Pinzler, L., Gazzola, V., Keysers, C., Sommer, J., Jansen, A., Frässle, S., Einhäuser, W., Paulus, F. M. & Krach, S. (2015) Neural pathways of embarrassment and their modulation by social anxiety. *NeuroImage* 119:252–61. [SD]

Müller-Pinzler, L., Krach, S., Krämer, U. M. & Paulus, F. M. (2017) The social neuroscience of interpersonal emotions. *Current Topics in Behavioral Neuroscience* 30:241–56. [SD]

Müller-Pinzler, L., Rademacher, L., Paulus, F. M. & Krach, S. (2016) When your friends make you cringe: Social closeness modulates vicarious embarrassment-related neural activity. *Social Cognitive and Affective Neuroscience* 11:466–75. [SD]

Nagel, J. (2015) The social value of reasoning in epistemic justification. *Episteme* 12 (2):297–308. Available at: https://www.cambridge.org/core/journals/episteme/article/the-social-value-of-reasoning-in-epistemic-justification/01BFE98E16528B9EB6E55E7A2670BEE7. [aJBM]

Nagy, D. G. & Orban, G. (2016) Episodic memory as a prerequisite for online updating of model structure. In: *Proceedings of the 38th Annual Conference of the Cognitive Science Society*, ed. A. Papafragou, D. Grodner, D. Mirman & J. C. Trueswell, pp. 2699–704. Cognitive Science Society. Available at: https://mindmodeling.org/cogsci2016/papers/0465/index.html. [aJBM]

Nairne, J. S., Thompson, S. R. & Pandeirada, J. N. (2007) Adaptive memory: Survival processing enhances retention. *Journal of Experimental Psychology: Learning, Memory, and Cognition* 33(2):263–73. [TE]

Naito, M. (2003) The relationship between theory of mind and episodic memory: Evidence for the development of autonoetic consciousness. *Journal of Experimental Child Psychology* 85:312–36. [rJBM]

Nash, R. A., Berkowitz, S. R. & Roche, S. (2016) Public attitudes on the ethics of deceptively planting false memories to motivate healthy behavior. *Applied Cognitive Psychology* 30:885–97. [RAN]

Nash, R. A., Wade, K. A., Garry, M. & Adelman, J. S. (2017) A robust preference for cheap-and-easy strategies over reliable strategies when verifying personal memories. *Memory* 25:890–99. [RAN]

Nash, R. A., Wheeler, R. L. & Hope, L. (2015) On the persuadability of memory: Is changing people's memories no more than changing their minds? *British Journal of Psychology* 106(2):308–26. Available at: http://onlinelibrary.wiley.com/doi/10.1111/bjop.12074/full. [aJBM, RAN]

Neisser, U. (1967) *Cognitive psychology*. Appleton-Century-Crofts. [DCR]

Neisser, U. (1976) *Cognition and reality: Principles and implications of cognitive psychology*. W. H. Freeman. [DCR]

Neisser, U. (1981) John Dean's memory: A case study. *Cognition* 9(1):1–22. Available at: http://www.sciencedirect.com/science/article/pii/0010027781900111. [aJBM]

Neisser, U. & Fivush, R. (1994) *The remembering self: Construction and accuracy in the self-narrative*. Cambridge University Press. [DCR]

Neisser, U. & Harsch, N. (1992) Phantom flashbulbs: False recollections of hearing the news about Challenger. In: *Affect and accuracy in recall*, ed. E. Winograd & U. Neisser, pp. 9–31. Cambridge University Press. Available at: https://doi.org/10.1017/CBO9780511664069.003. [MW]

Nelson, K. (1993) The psychological and social origins of autobiographical memory. *Psychological Science* 4(1):7–14. Available at: http://pss.sagepub.com/content/4/1/7.short. [aJBM, KN]

Nelson, K. (2007) *Young minds in social worlds: Experience, meaning and memory*. Harvard University Press. [KN]

Nelson, K. (2017) The cultural construction of memory in early childhood. In: *Handbook of culture and memory*, ed. B. Wagoner, pp. 185–208. Oxford University Press. [KN]

Nelson, K. & Fivush, R. (2004) The emergence of autobiographical memory: A social cultural developmental theory. *Psychological Review* 111(2):486–511. Available at: http://psycnet.apa.org/journals/rev/111/2/486/. [aJBM]

Nesse, R. M. (2013) Tinbergen's four questions, organized: A response to Bateson and Laland. *Trends in Ecology & Evolution* 28(12):681–82. [JR]

Newman, E. J. & Lindsay, D. S. (2009) False memories: What the hell are they for? *Applied Cognitive Psychology* 23:1105–21. [RAN]

Norrick, N. R. (2000) *Conversational narrative: Storytelling in everyday talk*. John Benjamins. [J-LD]

Nysberg, L., Kim, A. S. N., Habib, R., Levine, B. & Tulving, E. (2010) Consciousness of subjective time in the brain. *Proceedings of the National Academy of Sciences USA* 107(51):22356–59. Available at: http://www.pnas.org/content/107/51/22356.short. [aJBM]

O'Donnell, S., Oluyomi Daniel, T. & Epstein, L. H. (2017) Does goal relevant episodic future thinking amplify the effect on delay discounting? *Consciousness and Cognition* 51:10–16. Available at: https://doi.org/10.1016/j.concog.2017.02.014. [RGB]

Oeberst, A. & Blank, H. (2012) Undoing suggestive influence of memory: The reversibility of the eyewitness misinformation effect. *Cognition* 152(2):141–59. Available at: http://www.sciencedirect.com/science/article/pii/S001002771200159X. [aJBM]

Okuda, J., Fujii, T., Ohtake, H., Tsukiura, T., Tanji, K., Suzuki, K., Kawashima, R., Fukuda, H., Itoh, M. & Yamadori, A. (2003) Thinking of the future and past: The role of the frontal pole and the medial temporal lobes. *NeuroImage* 19:1369–80. Available at: http://www.sciencedirect.com/science/article/pii/S1053811903001794. [aJBM]

Olick, J. K. & Levy, D. (1997) Collective memory and cultural constraint: Holocaust myth and rationality in German politics. *Sociological Review* 62(6):921–36. Available at: http://www.jstor.org/stable/2657347. [aJBM]

Olsen, R. K., Moses, S. N., Riggs, L. & Ryan, J. D. (2012) The hippocampus supports multiple cognitive processes through relational binding and comparison. *Frontiers in Human Neuroscience* 6 (Article 146, 13 pp.). Available at: http://journal.frontiersin.org/article/10.3389/fnhum.2012.00146/full. [aJBM]

Otgaar, H., Scoboria, A. & Smeets, T. (2013) Experimentally evoking nonbelieved memories for childhood events. *Journal of Experimental Psychology: Learning, Memory, & Cognition* 39:717–30. [RAN]

Otgaar, H. & Smeets, T. (2010) Adaptive memory: Survival processing increases both true and false memory in adults and children. *Journal of Experimental Psychology: Learning, Memory, and Cognition* 36(4):1010–16. [TE]

Palombo, D. J., Keane, M. M. & Verfaellie, M. (2015) The medial temporal lobes are critical for reward-based decision making under conditions that promote episodic future thinking. *Hippocampus* 25(3):345–53. Available at: https://doi.org/10.1002/hipo.22376. [RGB, KKS]

Papafragou, A., Hulbert, J. & Trueswell, J. (2008) Does language guide event perception? Evidence from eye movements. *Cognition* 108:155–84. [PC]

Papafragou, A., Massey, C. & Gleitman, L. (2002) Shake, rattle, 'n' roll: The representation of motion in language and cognition. *Cognition* 84:189–219. [PC]

Pärnamets, P., Hall, L. & Johansson, P. (2015) Memory distortions resulting from a choice blindness task. In: *Proceedings of the 37th Annual Conference of the Cognitive Science Society*, ed. D. C. Noelle, R. Dale, A. S. Warlaumont, J. Yoshimi, T. Matlock, C. D. Jennings & P. P. Maglio, pp. 1823–28. Cognitive Science Society. Available at: https://mindmodeling.org/cogsci2015/papers/0316/index.html. [aJBM]

Pasion, R., Fernandes, C., Pereira, M. R. & Barbosa, F. (2017) Antisocial behaviour and psychopathy: Uncovering the externalizing link in the P3 modulation. *Neuroscience & Biobehavioral Reviews*. Available at: https://doi.org/10.1016/j.neubiorev.2017.03.012. [FF]

Pasupathi, M., Fivush, R. & Hernandez-Martinez, M. (2016) Talking about it: Stories as paths to healing after violence. *Psychology of Violence* 6(1):49–56. Available at: http://psycnet.apa.org/journals/vio/6/1/49/. [RF]

Pasupathi, M., Stallworth, L. M. & Murdoch, K. (1998) How what we tell becomes what we know: Listener effects on speakers' long-term memory for events. *Discourse Processes* 26(1):1–25. Available at: http://www.tandfonline.com/doi/abs/10.1080/01638539809545035. [aJBM]

Paulus, F. M., Müller-Pinzler, L., Jansen, A., Gazzola, V. & Krach, S. (2015) Mentalizing and the role of the posterior superior temporal sulcus in sharing others' embarrassment. *Cerebral Cortex* 25:2065–75. [SD]

Payne, D. G., Elie, C. J., Blackwell, J. M. & Neuschatz, J. S. (1996) Memory illusions: Recalling, recognizing, and recollecting events that never occurred. *Journal of Memory and Language* 35:261–85. [aJBM]

Payne, J. D. & Kensinger, E. A. (2010) Sleep's role in the consolidation of emotional episodic memories. *Current Directions in Psychological Science* 19:290–95. [SD]

https://doi.org/10.1017/S0140525X17000012 Published online by Cambridge University Press

Payne, J. D., Schacter, D. L., Propper, R. E., Huang, L. W., Wamsley, E. J., Tucker, M. A., Walker, M. P. & Stickgold, R. (2009) The role of sleep in false memory formation. *Neurobiology of Learning and Memory* 92:327–34. [SD]

Penn, D. C., Holyoak, K. J. & Povinelli, D. J. (2008) Darwin's mistake: Explaining the discontinuity between human and nonhuman minds. *Behavioral and Brain Sciences* 31(2):109–30. [NK]

Penn, D. C. & Povinelli, D. J. (2007) Causal cognition in human and nonhuman animals: A comparative, critical review. *Annual Review of Psychology* 58(1):97–118. [NK]

Perner, J. (1991) *Understanding the representational mind*. MIT Press. [aJBM, JR]

Perner, J. (2001) Episodic memory: Essential distinctions and developmental implications. In: *The self in time: Developmental perspectives*, ed. C. Moore & K. Lemmon, pp. 181–202. Erlbaum. [aJBM]

Perner, J. (2012) Mini-meta: In search for minimal criteria of metacognition. In: *Foundations of metacognition*, ed. M. J. Beran, J. L. Brandl, J. Perner & J. Proust, pp. 94–116. Oxford University Press. Available at: http://www.oxford-scholarship.com/view/10.1093/acprof:oso/9780199646739.001.0001/acprof-9780199646739-chapter-006. [aJBM]

Perner, J., Kloo, D. & Stöttinger, E. (2007) Introspection & remembering. *Synthese* 159:253–70. Available at: http://link.springer.com/article/10.1007/s11229-007-9207-4. [aJBM]

Perner, J. & Ruffman, T. (1995) Episodic memory and autonoetic consciousness: Developmental evidence and a theory of childhood amnesia. *Journal of Experimental Child Psychology* 59:516–48. Available at: http://www.sciencedirect.com/science/article/pii/S0022096585710247. [aJBM]

Perrin, D. (2016) Asymmetries in subjective time. In: *Seeing the future: Theoretical perspectives on future-oriented mental time travel*, ed. K. Michaelian, S. B. Klein & K. K. Szpunar, pp. 39–61. Oxford University Press. [KM]

Peters, J. & Büchel, C. (2010) Episodic future thinking reduces reward delay discounting through an enhancement of prefrontal-mediotemporal interactions. *Neuron* 66(1):138–48. Available at: https://doi.org/10.1016/j.neuron.2010.03.026. [RGB, KKS]

Petro, L. S. & Muckli, L. (2016) The brain's predictive prowess revealed in primary visual cortex. *Proceedings of the National Academy of Sciences USA* 113 (5):1124–25. Available at: https://doi.org/10.1073/pnas.1523834113. [PR]

Picard, L., Mayor-Dubois, C., Maeder, P., Kalenzaga, S., Abram, M., Duval, C., Eustache, F., Roulet-Perez, E. & Piolino, P. (2013) Functional independence within the self-memory system: New insights from two cases of developmental amnesia. *Cortex* 49(6):1463–81. Available at: http://www.sciencedirect.com/science/article/pii/S001094521200305X. [aJBM]

Pillemer, D. B. (1998) *Momentous events, vivid memories*. Harvard University Press. [DB]

Pillemer, D. B. (2003) Directive functions of autobiographical memory: The guiding power of the specific episode. *Memory* 11:193–202. [DB]

Pillemer, D. B., Steiner, K. L., Kuwabara, K. J., Kirkegaard Thomsen, D. & Svob, B. (2015) Vicarious memories. *Consciousness and Cognition* 36:233–45. Available at: http://www.sciencedirect.com/science/article/pii/S1053810015001476. [aJBM]

Pool, R. (2008) Memory, history and the claims of the past. *Memory Studies* 1 (2):149–66. Available at: http://mss.sagepub.com/content/1/2/149.short. [aJBM]

Povinelli, D. J. (2000) *Folk physics for apes: The chimpanzee's theory of how the world works*. Oxford University Press. [NK]

Pratt, M. W. & Fiese, B. H., eds. (2004) *Family stories and the life course: Across time and generations*. Routledge. [RF]

Price, D. W. W. & Goodman, G. S. (1990) Visiting the wizard: Children's memory for a recurring event. *Child Development* 61(3):664–80. [NK]

Quinlan, D. M. & Brown, T. E. (2003) Assessment of short-term verbal memory impairments in adolescents and adults with ADHD. *Journal of Attention Disorders* 6:143–52. [FF]

Race, E., Keane, M. M. & Verfaellie, M. (2011) Medial temporal lobe damage causes deficits in episodic memory and episodic future thinking not attributable to deficits in narrative construction. *The Journal of Neuroscience* 31 (28):10262–69. Available at: https://doi.org/10.1523/JNEUROSCI.1145-11.2011. [RGB, JR]

Raichle, M (2010) Two views of brain function. *Trends in Cognitive Sciences* 14:180–90. [RAM]

Rasch, B. & Born, J. (2013) About sleep's role in memory. *Physiological Reviews* 93:681–766. [SD]

Rasmussen, A. S. & Berntsen, D. (2009) Emotional valence and the functions of autobiographical memories: Positive and negative memories serve different functions. *Memory & Cognition* 37:477–92. [DB, DCR]

Rasmussen, A. S., Ramsgaard, S. B. & Berntsen, D. (2015) The frequency and functions of involuntary and voluntary autobiographical memories across the day. *Psychology of Consciousness: Theory, Research, and Practice* 2:185–205. [DB]

Ratner, H. H., Smith, B. S. & Dion, S. A. (1986) Development of memory for events. *Journal of Experimental Child Psychology* 41(3):411–28. [NK]

Redshaw, J. (2014) Does metarepresentation make human mental time travel unique? *WIREs Cognitive Science* 5:519–31. Available at: http://onlinelibrary.wiley.com/doi/10.1002/wcs.1308/full. [aJBM, JR]

Redshaw, J. & Suddendorf, T. (2016) Children's and apes' preparatory responses to two mutually exclusive possibilities. *Current Biology* 26 (13):1758–62. [JR]

Reinders, A. A. T. S., Nijenhuis, E. R., Paans, A. M., Korf, J., Willemsen, A. T. M. & Den Boer, J. A. (2003) One brain, two selves. *NeuroImage* 20(4):2119–25. [JMo]

Reinitz, M. T., Lammers, W. J. & Cochran, B. P. (1992) Memory conjunction errors: Miscombination of stored stimulus features can produce illusions of memory. *Memory & Cognition* 20:1–11. [DLS]

Renoult, L., Davidson, P. S., Palombo, D. J., Moscovitch, M. & Levine, B. (2012) Personal semantics: At the crossroads of semantic and episodic memory. *Trends in Cognitive Sciences* 16(11):550–58. Available at: https://doi.org/10.1016/j.tics.2012.09.003. [BKH]

Rick, S. & Loewenstein, G. (2008) Intangibility in intertemporal choice. *Philosophical Transactions of the Royal Society B: Biological Sciences* 363 (1511):3813–24. Available at: https://doi.org/10.1098/rstb.2008.0150. [RGB]

Rimé, B. (2005) *Le partage social des émotions.* Presses Universitaires de France – PUF. [J-LD]

Rimé, B., Mesquita, B., Boca, S. & Philippot, P. (1991) Beyond the emotional event: Six studies on the social sharing of emotion. *Cognition & Emotion* 5(5–6):435–65. Available at: http://www.tandfonline.com/doi/abs/10.1080/02699939108411052. [aJBM]

Roberts, R. P., Schacter, D. L. & Addis, D. R. (2017) Scene construction and relational processing: Separable constructs? *Cerebral Cortex.* Advance online publication. Available at: https://doi.org/10.1093/cercor/bhx081. [DLS]

Roberts, W. A. & Feeney, M. C. (2009) The comparative study of mental time travel. *Trends in Cognitive Sciences* 13(6):271–77. [NK]

Robins, S. K. (2016a) Misremembering. *Philosophical Psychology* 29(3):432–47. Available at: http://www.tandfonline.com/doi/abs/10.1080/09515089.2015.1113245. [aJBM, SR]

Robins, S. K. (2016b) Representing the past: Memory traces and the causal theory of memory. *Philosophical Studies* 173(11):2993–3013. Available at: https://doi.org/10.1007/s11098-016-0647-x. Available at: http://link.springer.com/article/10.1007/s11098-016-0647-x. [aJBM]

Robins, S. K. (2017) Confabulation and constructive memory. *Synthese*. Available at: https://doi.org/10.1007/s11229-017-1315-1. [SR]

Robinson, E. J. & Whitcombe, E. L. (2003) Children's suggestibility in relation to their understanding about source of knowledge. *Child Development* 74(1):48–62. [rJBM]

Rodriguez, D. N. & Strange, D. (2015) False memories for dissonance inducing events. *Memory* 23(2):203–12. Available at: http://www.tandfonline.com/doi/abs/10.1080/09658211.2014.881501. [aJBM]

Roediger, H. L. (1996) Memory illusions. *Journal of Memory and Language* 35:76–100. Available at: http://www.sciencedirect.com/science/article/pii/S0749596X96900054. [aJBM]

Roediger, H. L. (2001) Why retrieval is the key process in understanding human memory. In: *Memory, consciousness and the brain: The Tallinn conference*, ed. E. Tulving, pp. 52–75. Psychology Press. [aJBM]

Roediger, H. L. & McDermott, K. B. (1995) Creating false memories: Remembering words not presented on lists. *Journal of Experimental Psychology: Learning, Memory and Cognition* 21(4):803–14. Available at: http://psycnet.apa.org/psycinfo/1995-42833-001. [aJBM]

Rosenbaum, R. S., Kohler, S., Schacter, D. L., Moscovitch, M., Westmacott, R., Black, S. E., Gao, F. & Tulving, E. (2005) The case of K.C.: Contributions of a memory-impaired person to memory theory. *Neuropsychologia* 43:989–1021. [KKS]

Rosenbaum, R. S., Stuss, D. T., Levine, B. & Tulving, E. (2007) Theory of mind is independent of episodic memory. *Science* 318:1257. [rJBM]

Ross, M. (1989) Relation of implicit theories to the construction of personal histories. *Psychological Review* 96(2):341–57. Available at: http://psycnet.apa.org/journals/rev/96/2/341/. [aJBM]

Ross, M., McFarland, C., Conway, M. & Zanna, M. P. (1983) Reciprocal relation between attitudes and behavior recall. *Journal of Personality and Social Psychology* 45(2):257–67. Available at: http://psycnet.apa.org/journals/psp/45/2/257/. [aJBM]

Ross, M., McFarland, C. & Fletcher, O. J. (1981) The effect of attitude on the recall of personal histories. *Journal of Personality and Social Psychology* 40(4):627–34. Available at: http://psycnet.apa.org/journals/psp/40/4/627/. [aJBM]

Rubin, D. C., ed. (1986) *Autobiographical memory*. Cambridge University Press. [DB]

Rubin, D. C., ed. (1996) *Remembering our past: Studies in autobiographical memory.* Cambridge University Press. [DB]

Rubin, D. C. (2006) The basic-systems model of episodic memory. *Perspectives on Psychological Science* 1:277–311. [DCR]

https://doi.org/10.1017/S0140525X17000012 Published online by Cambridge University Press

Rubin, D. C. (2014) Schema driven construction of future autobiographical traumatic events: The future is much more troubling than the past. *Journal of Experimental Psychology: General* 143:612–30. [DCR]

Rubin, D. C. & Greenberg, D. L. (1998) Visual memory-deficit amnesia: A distinct amnesic presentation and etiology. *Proceedings of the National Academy of Sciences USA* 95:5413–16. [DCR]

Rubin, D. C., Schrauf, R. W. & Greenberg, D. L. (2003) Belief and recollection of autobiographical memories. *Memory & Cognition* 32(6):887–901. Available at: http://link.springer.com/article/10.3758/BF03196443. [aJBM]

Rubin, D. C. & Umanath, S. (2015) Event memory: A theory of memory for laboratory, autobiographical and fictional events. *Psychological Review* 122(1):1–23. Available at: http://psycnet.apa.org/journals/rev/122/1/1/. [aJBM, DCR]

Russell, J. (2014) Episodic memory as re-experiential memory: Kantian, developmental and neuroscientific currents. *Review of Philosophy and Psychology* 5 (3):391–411. Available at: http://link.springer.com/article/10.1007/s13164-014-0194-3. [aJBM]

Russell, J. & Hanna, R. (2012) A minimalist approach to the development of episodic memory. *Mind and Language* 27(1):29–54. Available at: https://doi.org/10.1111/j.1468-0017.2011.01434.x. [arJBM, MW]

Ryan, E. & See, S. (1993) Age-based beliefs about memory changes for self and others across adulthood. *Journal of Gerontology* 48:199–201. [WH]

Santioso, R., Fong, G. T. & Kunda, Z. (1990) Motivated recruitment of autobiographical memories. *Journal of Personality and Social Psychology* 59(2): 229–41. [aJBM]

Schacter, D. L. (1996) *Searching for memory: The brain, the mind, and the past*. Basic Books. [FF]

Schacter, D. L. (2001) *The seven sins of memory: How the mind forgets and remembers*. Houghton Mifflin Harcourt. [aJBM, AC, FF, JH, DLS]

Schacter, D. L. (2012) Adaptive constructive processes and the future of memory. *American Psychologist* 67:603–13. [DLS]

Schacter, D. L. & Addis, D. R. (2007) The cognitive neuroscience of constructive memory: Remembering the past and imagining the future. *Philosophical Transactions of the Royal Society B: Biological Sciences* 362:773–86. Available at: http://rstb.royalsocietypublishing.org/content/362/1481/773.short. [arJBM, KM, DLS]

Schacter, D. L. & Addis, D. R. (2009) On the nature of medial temporal lobe contributions to the constructive simulation of future events. *Philosophical Transactions of the Royal Society B: Biological Sciences* 364:1245–53. Available at: http://rstb.royalsocietypublishing.org/content/364/1521/1245.short. [aJBM]

Schacter, D. L., Addis, D. R. & Buckner, R. L. (2007) Remembering the past to imagine the future: The prospective brain. *Nature Reviews Neuroscience* 8 (9):657–61. Available at: https://doi.org/10.1038/nrn2213. [aJBM, RGB, JH, JR]

Schacter, D. L., Addis, D. R., Hassabis, D., Martin, V. C., Spreng, R. N. & Szpunar, K. K. (2012) The future of memory: Remembering, imagining, and the brain. *Neuron* 76:677–94. Available at: http://www.sciencedirect.com/science/article/pii/S0896627312009919. [aJBM, DLS]

Schacter, D. L., Benoit, R. G., De Brigard, F. & Szpunar, K. K. (2015) Episodic future thinking and episodic counterfactual thinking: Intersections between memory and decisions. *Neurobiology of Learning and Memory* 117:14–21. Available at: https://doi.org/10.1016/j.nlm.2013.12.008. [RGB, DLS]

Schacter, D. L., Benoit, R. G. & Szpunar, K. K. (2017) Episodic future thinking: Mechanisms and functions. *Current Opinion in Behavioral Sciences* 17:41–50. Available at: https://doi.org/10.1016/j.cobeha.2017.06.002. [RGB]

Schacter, D. L., Guerin, S. A. & St. Jacques, P. (2011) Memory distortion: An adaptive perspective. *Trends in Cognitive Sciences* 15(10):467–74. Available at: http://www.cell.com/trends/cognitive-sciences/abstract/S1364-6613(11)00174-4. [aJBM]

Schacter, D. L. & Madore, K. P. (2016) Remembering the past and imagining the future: Identifying and enhancing the contribution of episodic memory. *Memory Studies* 9(3):245–55. [DLS, rJBM]

Schelling, T. (1960) *The strategy of conflict*. Harvard University Press. [aJBM]

Scherman, A. Z., Salgado, S., Shao, Z. & Berntsen, D. (2017) Life script events and autobiographical memories of important life story events in Mexico, Greenland, China, and Denmark. *Journal of Applied Research in Memory and Cognition* 6 (1):60–73. [RF]

Schino, G. & Aureli, F. (2009) Reciprocal altruism in primates: Partner choice, cognition and emotions. *Advances in the Study of Behavior* 39:45–69. Available at: http://www.sciencedirect.com/science/article/pii/S0065345409390026. [aJBM]

Schino, G. & Aureli, F. (2010) Primate reciprocity and its cognitive requirements. *Evolutionary Anthropology* 19:130–35. Available at: http://onlinelibrary.wiley.com/doi/10.1002/evan.20270/full. [aJBM]

Schmolck, H., Buffalo, E. A. & Squire, L. R. (2000) Memory distortions develop over time: Recollections of the OJ Simpson trial verdict after 15 and 32 months. *Psychological Science* 11(1):39–45. [JR]

Schooler, J. W., Foster, R. A. & Loftus, E. F. (1988) Some deleterious consequences of the act of recollection. *Memory & Cognition* 16(3):243–51. Available at: http://link.springer.com/article/10.3758/BF03197757. [aJBM]

Schwitzgebel, E. (2011) *Perplexities of consciousness*. Harvard University Press. [PC]

Scoboria, A., Jackson, D. L., Talarico, J., Hanczakowski, M., Wzsman, L. & Mazzoni, G. (2014) The role of belief in occurrence within autobiographical memory. *Journal of Experimental Psychology: General* 143(3):1242–58. Available at: http://psycnet.apa.org/psycinfo/2013-29649-001/. [aJBM, RAN]

Scoboria, A., Nash, R. A. & Mazzoni, G. (2017) Sub-types of nonbelieved memories reveal differential outcomes of challenges to memories. *Memory* 25:876–889. [RAN]

Searight, H. R., Rottnek, F. & Abby, S. L. (2001) Conduct disorder: Diagnosis and treatment in primary care. *American Family Physician* 63:1579–89. [FF]

Seeman, A. (2016) Reminiscing together: Joint experiences, epistemic groups, and sense of self. *Synthese* 1–16. Available at: https://doi.org/10.1007/s11229-016-1156-3. [rJBM]

Sheldon, S. & Moscovitch, M. (2010) Recollective performance advantages for implicit memory tasks. *Memory* 18(7):681–97. Available at: http://www.tandfonline.com/doi/abs/10.1080/09658211.2010.499876. [aJBM]

Slobin, D. (1996) From "thought and language" to "thinking for speaking." In: *Rethinking linguistic relativity*, ed. J. Gumperz & S. Levinson, pp. 70–96. Cambridge University Press. [PC]

Smith, C. H., Oakley, D. A. & Morton, J. (2013) Increased response time of primed associates following an "episodic" hypnotic amnesia suggestion: A case of unconscious volition. *Consciousness and Cognition* 22(4):1305–17. Available at: https://doi.org/10.1016/j.concog.2013.08.003. [JMo]

Smolin, L. (2006) *The trouble with physics: The rise of string theory, the fall of a science, and what comes next*. Houghton Mifflin Harcourt. [FF]

Smolin, L. (2013) *Time reborn: From the crisis in physics to the future of the universe*. Houghton Mifflin Harcourt. [FF]

Söderlund, H., Kumar, N., Flint, A., Moscovitch, M., Daskalakis, Z. J., Herrmann, N. & Levine, B. (2014) Autobiographical episodic memory in major depressive disorder. *Journal of Abnormal Psychology* 123:51–60. [FF]

Southgate, V., Chevallier, C. & Csibra, G. (2010) Seventeen-month-olds appeal to false beliefs to interpret others' referential communication. *Developmental Science* 13:907–12. [DK]

Speas, P. (2008) On the syntax and semantics of evidentials. *Language and Linguistics Compass* 2(5):940–65. Available at: http://onlinelibrary.wiley.com/doi/10.1111/j.1749-818X.2008.00069.x/full. [aJBM]

Sperber, D. (1997) Intuitive and reflective beliefs. *Mind and Language* 12(1):67–83. [rJBM]

Sperber, D. (2000) Metarepresentations in an evolutionary perspective. In: *Metarepresentations: A multidisciplinary perspective*, ed. D. Sperber, pp. 117–137. Oxford University Press. [aJBM]

Sperber, D. (2001) An evolutionary perspective on testimony and argumentation. *Philosophical Topics* 29:401–13. Available at: https://www.pdcnet.org//pdc/bvdb.nsf/purchase?openform&fp=philtopics&id=philtopics_2001_0029_0001_0401_0414&conlyautologin=true. [aJBM]

Sperber, D., Clément, F., Heintz, C., Mascaro, O., Mercier, H., Origgi, G. & Wilson, D. (2010) Epistemic vigilance. *Mind & Language* 25(4):359–93. Available at: http://onlinelibrary.wiley.com/doi/10.1111/j.1468-0017.2010.01394.x/full. [aJBM]

Sperber, D. & Hirschfeld, L. A. (2004) The cognitive foundations of cultural stability and diversity. *Trends in Cognitive Sciences* 8(1):40–46. Available at: http://www.sciencedirect.com/science/article/pii/S1364661303003140. [aJBM]

Sperber, D. & Wilson, D. (1986) *Relevance: Communication and cognition*. Blackwell. [WH]

Sperber, D. & Wilson, D. (2002) Pragmatics, modularity and mind-reading. *Mind & Language* 17(1):3–23. [rJBM]

Spreng, R. N. & Andrews-Hanna, J. R. (2015) The default network and social cognition. In: *Brain mapping: An encyclopedic reference*, ed. A. W. Toga, pp. 165–69. Academic Press/Elsevier. [RAM]

Spreng, R. N., Mar, R. A. & Kim, A. S. N. (2009) The common neural basis of autobiographical memory, prospection, navigation, theory of mind and the default mode: A quantitative meta-analysis. *Journal of Cognitive Neuroscience* 21(3):489–510. Available at: http://www.mitpressjournals.org/doi/abs/10.1162/jocn.2008.21029. [aJBM, RAM]

Squire, L. R. (1992) Declarative and non-declarative memory: Multiple brain systems supporting learning and memory. *Journal of Cognitive Neuroscience* 4 (3):232–43. Available at: http://www.mitpressjournals.org/doi/abs/10.1162/jocn.1992.4.3.232#.V-Fx5JN97m0. [aJBM]

Squire, L. R., van der Horst, A. S., McDuff, S. G. R., Frascino, J. C., Hopkins, R. O. & Mauldin, K. N. (2010) Role of the hippocampus in remembering the past and imagining the future. *Proceedings of the National Academy of Sciences USA* 107(44):19044–48. Available at: https://doi.org/10.1073/pnas.1014391107. [RGB]

St. Jacques, P. (2012) Functional neuroimaging of autobiographical memory. In: *Understanding autobiographical memory: Theories and approaches*, ed. D. Berntsen & D. C. Rubin, pp. 114–38. Cambridge University Press. [DCR]

Stanley, M. L., Parikh, N., Stewart, G. W. & De Brigard, F. (2017) Emotional intensity in episodic autobiographical memory and counterfactual thinking.

https://doi.org/10.1017/S0140525X17000012 Published online by Cambridge University Press

Consciousness and Cognition 48:283–91. Available at: https://doi.org/10.1016/j.concog.2016.12.013. [RGB]

Startup, M., Makgekgenene, L. & Webster, R. (2007) The role of self-blame for trauma as assessed by the Posttraumatic Cognitions Inventory (PTCI): A self-protective cognition? *Behaviour Research and Therapy* 45(2):395–403. [TE]

Stewart, N., Chater, N. & Brown, G. D. A. (2006) Decision by sampling. *Cognitive Psychology* 53:1–26. Available at: https://doi.org/10.1016/j.cogpsych.2005.10.003. [BKH]

Stone, C. B., Barnier, A. J., Sutton, J. & Hirst, W. (2010) Building consensus about the past: Schema consistency and convergence in socially-shared retrieval-induced forgetting. *Memory* 18:170–84. [AC]

Stone, V. E. & Gerrans, P. (2006) What's domain-specific about theory of mind? *Social Neuroscience* 1(3–4):309–19. [JR]

Suddendorf, T. (1999) The rise of the metamind. In: *The descent of mind: Psychological perspectives on hominid evolution*, ed. M. C. Corballis & S. E. G. Lea, pp. 218–60. Oxford University Press. [JR]

Suddendorf, T. (2013) *The gap: The science of what separates us from other animals*. Basic Books. [JR]

Suddendorf, T., Addis, D. R. & Corballis, M. C. (2009) Mental time travel and the shaping of the human mind. *Philosophical Transactions of the Royal Society B: Biological Sciences* 364(1521):1317–24. Available at: http://rstb.royalsocietypublishing.org/content/364/1521/1317.short. [aJBM, JR]

Suddendorf, T. & Busby, J. (2003) Mental time travel in animals? *Trends in Cognitive Sciences* 7(9):391–96. [JR]

Suddendorf, T. & Corballis, M. C. (1997) Mental time travel and the evolution of the human mind. *Genetic, Social & General Psychology Monographs* 123(2):133–67. Available at: http://cogprints.org/725/. [aJBM, KM, JR]

Suddendorf, T. & Corballis, M. C. (2007) The evolution of foresight: What is mental time travel, and is it unique to humans? *Behavioral and Brain Sciences* 30 (3):299–313. [aJBM, J-LD, JR, DLS]

Summerfield, D. (1997) South Africa: Does a truth commission produce social reconciliation? *British Medical Journal* 315(7120):1393. [RF]

Sutherland, K. & Bryant, R. A. (2008) Autobiographical memory and the self-memory system in posttraumatic stress disorder. *Journal of Anxiety Disorders* 22(3):555–60. [TE]

Sweatt, J. D. (2010) *Mechanisms of memory*, 3rd edition. Academic Press. [SA]

Szpunar, K. K. (2010) Episodic future thought: An emerging concept. *Perspective on Psychological Science* 5:142–62. Available at: http://pps.sagepub.com/content/5/2/142.short. [aJBM, KM]

Szpunar, K. K. & McDermott, K. B. (2008a) Episodic future thought and its relation to remembering: Evidence from ratings of subjective experience. *Consciousness and Cognition* 17:330–34. Available at: http://www.sciencedirect.com/science/article/pii/S1053810007000311. [aJBM]

Szpunar, K. K. & McDermott, K. B. (2008b) Episodic memory: An evolving concept. In: *Learning and memory: A comprehensive reference, vol. 2: Cognitive psychology of memory*, ed. J. H. Byrne, pp. 491–509. Elsevier. [KKS]

Szpunar, K. K., Spreng, R. N. & Schacter, D. L. (2014) A taxonomy of prospection: Introducing an organizational framework for future-oriented cognition. *Proceedings of the National Academy of Sciences USA* 111:18414–21. [KKS]

Szpunar, K. K., Watson, J. M. & McDermott, K. B. (2007) Neural substrates of envisioning the future. *Proceedings of the National Academy of Sciences of the United States of America* 104(2):642–47. Available at: https://doi.org/10.1073/pnas.0610082104. [RGB]

Talarico, J. M. & Rubin, D. C. (2003) Confidence, not consistency, characterizes flashbulb memories. *Psychological Science* 14(5):455–61. [MW]

Talland, G. A. (1964) Self-reference: A neglected component in remembering: Comment. *American Psychologist* 19:465–83. [JN]

Talwar, V. & Crossman, A. M. (2011) From little white lies to filthy liars: The evolution of honesty and deception in young children. *Advances in Child Development and Behavior* 40:139–79. [FF]

Tannen, D. (1984) *Conversational style – Analyzing talk among friends*. Ablex. [J-LD]

Tattersall, I. (2012) *Masters of the planet: The search for our human origins*. Palgrave Macmillan. [FF]

Tavares, R., William, C., Grossman, Y., Mendelsohn, A., Shapiro, M., Trope, Y. & Schiller, D. (2015) A map for social navigation in the human brain. *Neuron* 87:231–43. [RAM]

Templer, V. L. & Hampton, R. R. (2012) Rhesus monkeys (*Macaca mulatta*) show robust evidence for memory awareness across multiple generalization tests. *Animal Cognition* 15(3):409–19. [SS]

Templer, V. L. & Hampton, R. R. (2013) Episodic memory in nonhuman animals. *Current Biology* 23(17):R801–R806. Available at: http://www.sciencedirect.com/science/article/pii/S0960982213008397. [aJBM]

Tenney, E. R., MacCoun, R. J., Spellman, B. A. & Hastie, R. (2007) Calibration trumps confidence as a basis for witness credibility. *Psychological Science* 18:46–50. [RAN]

Teroni, F. (2014) The epistemological disunity of memory. In: *Mind, values and metaphysics: Philosophical papers dedicated to Kevin Mulligan, vol. 2*, ed. A. Reboul, pp. 183–202. Springer. [aJBM]

Terrier, N., Bernard, S., Mercier, H. & Clément, F. (2016) Visual access trumps gender in 3- and 4-year-old children's endorsement testimony. *Journal of Experimental Child Psychology* 146:223–30. Available at: http://www.sciencedirect.com/science/article/pii/S0022096516000308. [aJBM]

Tinbergen, N. (1963) On aims and methods of ethology. *Ethology* 20(4):410–33. [JR]

Todd, R. M., Ehlers, M., Müller, D. J., Robertson, A., Palombo, D. J., Freeman, N. Levine, B. & Anderson, A. K. (2015) Neurogenetic variations in norepinephrine availability enhance perceptual vividness. *Journal of Neuroscience* 35(16):6506–16. [TE]

Todd, R. M., Müller, D. J., Lee, D. H., Robertson, A., Eaton, T., Freeman, N., Palombo, D. J., Levine B. & Anderson, A. K. (2013) Genes for emotion-enhanced remembering are linked to enhanced perceiving. *Psychological Science* 24(11):2244–53. [TE]

Todd, R. M., Palombo, D., Müller, D. J., Robertson, A., Eaton, T., Freeman, N., Levine, B. & Anderson, A. K. (2014) Deletion variant in the ADRA2b gene increases coupling between emotional responses at encoding and later retrieval of emotional memories. *Neurobiology of Learning and Memory* 112:222–29. [TE]

Tomasello, M. (1999) *The cultural origins of human cognition*. Harvard University Press. [DCR]

Tomasello, M. (2008) *Origins of human communication*. MIT Press. [FF]

Tomasello, M. (2016) *A natural history of human morality*. Harvard University Press. [FF]

Tomasello, M., Carpenter, M., Call, J., Behne, T. & Moll, H. (2005) Understanding and sharing intentions: The origins of cultural cognition. *Behavioral and Brain Sciences* 28(5):675–91. [NK, DCR]

Tooby, J. & Cosmides, L. (1992) Cognitive adaptations for social exchange. In: *The adapted mind: Evolutionary psychology and the generation of culture*, ed. J. H. Barkow, L. Cosmides & J. Tooby, pp. 163–228. Oxford University Press. [aJBM]

Trueswell, J. & Papafragou, A. (2010) Perceiving and remembering events cross-linguistically: Evidence from dual-task paradigms. *Journal of Memory and Language* 63:64–82. [PC]

Tulving, E. (1972) Episodic and semantic memory. In: *Organization of memory*, ed. E. Tulving & W. Donaldson, pp. 381–402. Academic Press. [aJBM]

Tulving, E. (1983a) *Elements of episodic memory*. Clarendon Press. [aJBM, HB]

Tulving, E. (1983b) *Elements of episodic memory*. Oxford University Press. [KN, KKS]

Tulving, E. (1984) Précis of elements of episodic memory. *Behavioral and Brain Sciences* 7:223–68. [DCR]

Tulving, E. (1985) Memory and consciousness. *Canadian Psychology* 26:1–12. Available at: http://psycnet.apa.org/journals/cap/26/1/1/. [aJBM, WH, DCR, KKS]

Tulving, E. (2002a) Episodic memory: From mind to brain. *Annual Review of Psychology* 53: 1–25. Available at: http://www.annualreviews.org/doi/abs/10.1146/annurev.psych.53.100901.135114. [aJBM, KKS]

Tulving, E. (2002b) Chronesthesia: Conscious awareness of subjective time. In: *Principles of frontal lobe function*, ed. D. T. Stuss & R. C. Knight, pp. 311–25. Oxford University Press. [KKS]

Tulving, E. (2005) Episodic memory and autonoesis: Uniquely human? In: *The missing link in cognition: Origins of self-selective consciousness*, ed. H. S. Terrace & J. Metcalfe, pp. 3–56. Oxford University Press. [aJBM]

Tulving, E. & Szpunar, K. K. (2012) Does the future exist? In: *The mind and the frontal lobes: Cognition, behavior, and brain imaging*, ed. B. Levine & F. I. M. Craik, pp. 248–63. Oxford University Press. [KKS]

Tulving, E. & Thomson, D. M. (1973) Encoding specificity and retrieval processes in episodic memory. *Psychological Review* 80(5):352–73. Available at: https://doi.org/10.1037/h0020071. [DK]

Turri, J. (2011) Promises to keep: Speech acts and the value of reflective knowledge. *Logos & Episteme* 2(4):583–90. Available at: https://www.pdcnet.org/logos-episteme/content/logos-episteme_2011_0002_0004_0583_0590. [aJBM]

Tversky, B. & Marsh, E. J. (2000) Biased retellings of events yield biased memories. *Cognitive Psychology* 40:1–38. Available at: http://www.sciencedirect.com/science/article/pii/S001002859990720X. [aJBM]

Vanderveldt, A., Oliveira, L. & Green, L. (2016) Delay discounting: Pigeon, rat, human – Does it matter? *Journal of Experimental Psychology: Animal Learning and Cognition* 42:141–62. [KKS]

Visalberghi, E. & Tomasello, M. (1998) Primate causal understanding in the physical and psychological domains. *Behavioural Processes* 42(2–3):189–203. [NK]

Von Fintel, K. & Gillies, A. S. (2010) Must … stay … strong! *Natural Language Semantics* 18(4):351–83. [JN]

von Hippel, W. & Trivers, R. (2011) The evolution and psychology of self-deception. *Behavioral and Brain Sciences* 34:1–56. Available at: https://www.cambridge.org/core/journals/behavioral-and-brain-sciences/article/div-classtitlethe-evolution-and-psychology-of-self-deceptiondiv/B87968EC4A6B4DC93A21-C217ABC13E13. [aJBM]

Vullioud, C., Clément, F., Scott-Phillips, T. & Mercier, H. (2017) Confidence as an expression of commitment: Why misplaced expressions of confidence backfire. *Evolution and Human Behavior* 38(1):9–17. Available at: https://doi.org/10.1016/j.evolhumbehav.2016.06.002. [arJBM]

https://doi.org/10.1017/S0140525X17000012 Published online by Cambridge University Press

Wade, K. A., Nash, R. A. & Garry, M. (2014) People consider reliability and cost when verifying their autobiographical memories. *Acta Psychologica* 146:28–34. [RAN]

Wagner, A. D., Desmond, J. E., Glover, G. H. & Gabrieli, J. D. E. (1998) Prefrontal cortex and recognition memory. Functional-MRI evidence for context-dependent retrieval processes. *Brain* 121(10):1985–2002. Available at: https://doi.org/10.1093/brain/121.10.1985. [DK]

Waldum, E. R. & Sahakyan, L. (2012) Putting congeniality effects into context: Investigating the role of context in attitude memory using multiple paradigms. *Journal of Memory and Language* 66: 717–30. Available at: http://www.sciencedirect.com/science/article/pii/S0749596X12000022. [aJBM]

Walker, R. W., Skowronski, J. J., Gibbons, J. A., Vogl, J. R. & Ritchi, T. D. (2009) Why people rehearse their memories: Frequency of use and relations to the intensity of emotions associated with autobiographical memories. *Memory* 17:760–73. [DB]

Wang, Q. (2013) The cultured self and remembering. In: *The Wiley handbook on the development of children's memory, vol. I/II*, ed. P. J. Bauer & R. Fivush, pp. 605–25. Wiley. [RF]

Wang, Q. (2016) Remembering the self in cultural contexts: A cultural dynamic theory of autobiographical memory. *Memory Studies* 9(3):295–304. [RF]

Webster, J. D. (1993) Construction and validation of the Reminiscence Functions Scale. *Journal of Gerontology* 48:256–62. [DB]

Webster, J. D. (1994) Predictors of reminiscence: A lifespan perspective. *Canadian Journal on Aging* 13:66–78. [DB]

Weiss, M. (1997) Bereavement, commemoration and collective identity in contemporary Israeli society. *Anthropological Quarterly* 70(2):91–101. Available at: http://www.jstor.org/stable/3317509. [aJBM]

Werning, M. (2005) Right and wrong reasons for compositionality. In: *The compositionality of meaning and content, vol. I*, ed. M. Werning, E. Machery & G. Schurz, pp. 285–309. Ontos Verlag. [MW]

Werning, M. & Cheng, S. (2017) Taxonomy and unity of memory. In: *Routledge handbook of philosophy of memory*, ed. S. Bernecker & K. Michaelian, pp. 7–20. Routledge. [MW]

Wheeler, M. E., Petersen, S. E. & Buckner, R. L. (2000) Memory's echo: Vivid remembering reactivates sensory-specific cortex. *Proceedings of the National Academy of Sciences USA* 97(20):11125–29. Available at: http://www.pnas.org/content/97/20/11125.full. [aJBM]

Wheeler, M. E., Stuss, D. T. & Tulving, E. (1997) Toward a theory of episodic memory: The frontal lobes and autonoetic consciousness. *Psychological Bulletin*, 121(3): 331–54. Available at: https://www.ncbi.nlm.nih.gov/pubmed/9136640. [aJBM]

Whitcombe, E. L. & Robinson, E. J. (2000) Children's decisions about what to believe and their ability to report the source of their belief. *Cognitive Development* 15:329–46. Available at: http://www.sciencedirect.com/science/article/pii/S0885201400000332. [arJBM]

Wilhelm, I., Diekelmann, S., Molzow, I., Ayoub, A., Molle, M. & Born, J. (2011) Sleep selectively enhances memory expected to be of future relevance. *The Journal of Neuroscience* 31:1563–69. [SD]

Williams, H. L., Conway, M. A. & Baddeley, A. D. (2008) The boundaries of episodic memories. In: *Understanding events: From perception to action*, ed. T. F. Shipley & J. M. Zacks, pp. 39–52. Oxford University Press. [JMi]

Williamson, T. (2007) Philosophical knowledge and knowledge of counterfactuals. *Grazer Philosophische Studien* 74:89–123. [FDB]

Williamson, T. (2016) Knowing by imagining. In: *Knowledge through imagination*, ed. A. Kind & P. Kung, pp. 113–23. Oxford University Press. [FDB]

Wilson, A. E. & Ross, M. (2003) The identity function of autobiographical memory: Time is on our side. *Memory* 11:137–49. [RAN]

Wilson, D. (2000) Metarepresentation in linguistic communication. In: *Metarepresentations: An interdisciplinary perspective*, ed. D. Sperber, pp. 411–48. Oxford University Press. [JR]

Wimmer, E. L., Hogrefe, G. J. & Perner, J. (1988) Children's understanding of informational access as a source of knowledge. *Child Development* 59(2):386–96. Available at: http://www.jstor.org/stable/1130318. [aJBM]

Winter, J. (2001) The memory boom in contemporary historical studies. *Raritan* 21 (1):52. Available at: http://raritanquarterly.rutgers.edu/node/6310. [aJBM]

Wixted, J. T. & Wells, G. L. (2017) The relationship between eyewitness confidence and identification accuracy: a new synthesis. *Psychological Science in the Public Interest* 18(1):10–65. [rJBM]

Wolford, G., Miller, M. B. & Gazzaniga, M. (2000) The left hemisphere's role in hypothesis formation. *Journal of Neuroscience* 20:1–4. [FF]

Wolpert, D. M., Ghahramani, Z. & Jordan, M. I. (1995) An internal model for sensorimotor integration. *Science* 269(5232):1880–82. [PR]

Wolpert, D. M., Goodbody, S. J. & Husain, M. (1998) Maintaining internal representations: The role of the human superior parietal lobe. *Nature Neuroscience* 1 (6):529–33. Available at: https://doi.org/10.1038/2245. [PR]

Yates, F. A. (1966) *The art of memory*. University of Chicago Press. [RAM]

Zeithamova, D. & Preston, A. R. (2010) Flexible memories: Differential roles for medial temporal lobe and prefrontal cortex in cross-episode binding. *Journal of Neuroscience* 30:14676–84. [DLS]

https://doi.org/10.1017/S0140525X17000012 Published online by Cambridge University Press