Mnemicity – A cognitive gadget?

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Abstract

Episodic representations can be entertained either as 'remembered' or as 'imagined' – as outcomes of experience or as simulations of such experience. Here, we argue that this feature is the product of a dedicated cognitive function: the metacognitive capacity to determine the *'mnemicity'* of mental event simulations. We argue that mnemicity attribution should be distinguished from other metacognitive operations (such as reality monitoring) and propose that this attribution is a 'cognitive gadget' – a distinctively human ability made possible by cultural learning. Cultural learning is a type of social learning in which traits are inherited through social interaction. In the case of mnemicity, one culturally learns to discriminate metacognitive 'feelings of remembering' from other perceptual, emotional, action-related, and metacognitive feelings; to interpret 'feelings of remembering' as indicators of memory rather than imagination; and to broadcast the interpreted feelings in culture- and context-specific ways – for example, as 'I was there', or 'I witnessed it myself'. We review evidence from the literatures on memory development and scaffolding, metacognitive learning and teaching, as well as cross-cultural psychology in support of this view before pointing out various open questions about the nature and development of mnemicity highlighted by our account.

What happened on your 18th birthday? The attempt to answer this question will likely conjure up images of people, places, and sensations. But what makes you treat these images as *memories* as opposed to imaginings? What gives them, as we will refer to it, their '*mnemicity'* (Michaelian & Sutton, 2017)? Note that this is not a question about the objective criteria a given mental state has to fulfill in order to qualify as a memory. Rather, it is a question about how a given mental representation comes to be *treated* by your cognitive system as a memory.

Even though the question of how a given representation achieves its mnemicity already exercised early modern thinkers like Hume (1985; Holland, 1954; Michaelian, 2016), one might think this problem does not commonly present itself when we are engaged in remembering. Memories might instead carry their memorial character 'on their sleeves'. However, recent evidence about the similarity of the neuro-cognitive systems underlying episodic memories and imaginations has lent renewed urgency to this debate. Such evidence comes from cognitive neuroscience, neuropsychology, and behavioral psychology (for reviews see e.g., Schacter et al., 2012; Addis, 2018; 2020) and suggests that both episodic memories of the past and imaginings of the future rely on a unitary 'episodic simulation' mechanism. If this is correct, it is unlikely that memories are intrinsically different from imaginations. When memory and imagination are both generated by a single simulation mechanism, distinguishing them does not come for free (Mahr, 2020).

Given evidence for a single episodic simulation mechanism, the capacity to generate such simulations and the capacity to differentiate these simulations into memories and imagination (i.e., to represent their mnemicity) must in principle be separable. And if we have separate capacities to generate episodic simulations and to represent the mnemicity of these simulations, these capacities must have separable ontogenetic and phylogenetic histories. But what are the origins of the distinction between memory and imagination? To what extent is mnemicity a 'cognitive instinct', developing as an inherent part of the episodic simulation system? And to what extent is mnemicity a cultural 'invention' specific to the human episodic memory system, passed on through cultural learning mechanisms?

In view of these considerations, this article has two aims: (1) to introduce and make precise the idea that episodic simulation involves mnemicity judgments; and (2) to develop a hypothesis about the origins of this capacity. Regarding (1), we argue that mnemicity is the result of a metacognitive attribution tracking the extent to which a given episodic

representation is the outcome of personal experience. As such, it is neither an intrinsic feature of episodic representations nor identical to judgments of 'reality' (i.e., judgments about whether an event occurred or not). Regarding (2), we develop the view that mnemicity attribution might be a cognitive gadget (Heyes, 2018; Heyes, 2019; Heyes et al., 2020; 2021): a culturally transmitted 'invention'.

We will proceed as follows: in Section 1, we answer some central questions about what mnemicity is, how episodic simulations come to be treated as memories, and what role mnemicity plays in the wider architecture of the human episodic memory system. In Section 2, we expand on our view that mnemicity is a cognitive gadget. We propose that the attribution of mnemicity is a metacognitive ability made possible by cultural learning: a distinctively human type of social learning in which traits are socially inherited – what I learn through social interaction with you resembles and is causally dependent on the information guiding your interactive behavior. In the case of mnemicity, we culturally learn to discriminate metacognitive 'feelings of remembering' (e.g., Whittlesea, 2002; Sharot, Delgado & Phelps, 2004; Perrin, Michaelian, & Sant'Anna, 2020) from other perceptual, emotional, action-related, and metacognitive feelings; to interpret these feelings as feelings of 'remembering'; and to broadcast the interpreted feelings in culture- and context-specific ways – for example, 'I was there', 'I witnessed it myself'. If mnemicity is acquired by individuals through cultural learning, it has the potential to be rendered adaptive at the population level by cultural selection – natural selection acting on culturally inherited, rather than genetically inherited, variants.

In Section 3, we review some evidence that mnemicity is a cognitive gadget. A major source of such evidence is research on sociocultural effects on memory development (Nelson & Fivush, 2004; Fivush et al., 2006). However, research on the origins of mnemicity is in many respects still in its infancy. For this reason, in Section 4, we point to a number of promising directions and questions that would have to be addressed to establish the extent to which mnemicity is a cognitive gadget.

1. What is mnemicity?

Why does a cognitive system like ours need to distinguish between remembering and imagining? Commonly, the distinction between remembering and imagining is thought to result from two architectural features of the episodic memory system.

On the one hand, Johnson and colleagues (Johnson & Raye, 1981; Johnson et al., 1993) have pointed out that we do not just encode our own perceptual experiences but also self-generated information like mental imagery. Therefore, when we seek to recall externally generated past experiences we have to distinguish them from internally generated ones. Most prominently, many situations require us to distinguish whether we merely planned an action or actually performed it (e.g., Brandt et al., 2013) – did you pack your keys or only think about packing them when you left the house? For this reason, the architecture of human episodic memory is thought to include 'reality monitoring' mechanisms (Simons et al., 2017).

Reality monitoring refers to a suite of mechanisms that track which of our mental experiences represent 'reality' or the external world. Thus understood, reality monitoring does not just apply to memory but to perception, too. Here, reality monitoring is thought to enable cognitive systems to distinguish self-generated imagery from externally-generated perception (for review, see Dijkstra et al., 2021). In the case of memory, this capacity amounts to the ability to distinguish between simulations that represent previous reality and simulations that do not (e.g., Simons et al., 2017).

On the other hand, as mentioned above, research conducted with a variety of methods has consistently found that the neuro-cognitive mechanisms responsible for generating episodic memories and imaginations are closely related. So closely related, in fact, that some have argued that remembering might be just one form of imagining (e.g. Addis, 2018; 2020; Michaelian, 2016; Michaelian, Perrin, & Sant'Anna, 2020; De Brigard, 2014; Schacter & Addis, 2020). Classically understood, remembering is the process of *retrieving* previous experiences (e.g., Martin & Deutscher, 1966) whereas imagining is the process of *constructing* novel experiences (van Leeuwen, 2013). As it turns out, however, this distinction does not seem to have a clear analogue in the architecture of the human mind. Instead, there does not seem to be a fundamental difference in cognitive terms between episodic representations that are the outcome of retrieval vs. construction. Instead of representing two neatly distinguishable cognitive categories, episodic memory and episodic imagination seem to lie on a continuum. However, even though the difference between remembering and imagining is not supplied by the cognitive architecture of the episodic memory system, most people nonetheless experience and conceptualize memory and imagination as different cognitive activities. This suggests the existence of cognitive mechanisms that track – notwithstanding the lack of a deep architectural difference grounding the distinction – the extent to which a given episodic representation is the result of

the retrieval of past experience vs. the construction of such experience (Klein, 2013). It is this capacity that we refer to when we say that a cognitive system is able to attribute *mnemicity* to episodic simulations that would otherwise lack such categorization.

Distinguishing mnemicity attribution from reality monitoring

Both the problem of distinguishing reality from mental imagery (i.e., reality monitoring) and the problem of distinguishing whether one's episodic simulation is the result of the retrieval of past experiences or of the construction of novel experiences (i.e., mnemicity attribution) are related to the cognitive origin of the distinction between memory and imagination. As such, one might think that they present different versions of the same cognitive challenge. Indeed, much of the psychological research in this domain seems to assume that judgments about whether one remembers vs. imagines cognitively reduce to reality monitoring processes. However, there are good conceptual and empirical reasons to think that judgments about whether one remembers are distinct from reality monitoring decisions (see e.g., Michaelian, 2016).

When reflecting on this distinction, it is important to keep in mind the difference between remembering 'experiences' vs. events (see also Hoerl, 2014). Reality monitoring and mnemicity attribution have different targets: Whereas mnemicity attribution seeks to track the extent to which a given episodic construction is the outcome of previous experience, reality monitoring assesses whether said construction corresponds to something real.[1] If reality and mnemicity were cognitively indistinguishable, it should be impossible for them to dissociate – one should be unable to episodically represent events that actually occurred but which one did not experience oneself, or events that one experienced but that did not actually occur. Yet, we can do both. Correspondingly, the distinction between reality monitoring and attributions of mnemicity is best illustrated by considering two particular kinds of episodic

[1] This distinction is also apparent in the debate about the contents of human episodic memory (see e.g., Michaelian & Sutton, 2017 for review). In this debate, it is common to point out that episodic memory in human adults seems to not just carry first-order content about past events (such as what-where-when information) but also second-order content about how said first-order content was acquired – namely, through personal experience (e.g., Fernandez, 2019; Mahr & Csibra, 2018; Dokic, 2001; Perner & Ruffman, 1995). Another way to put this is to say that one difference between episodic memory and perception is its representational *opacity*. Whereas the perception of an event does not include a representation of the fact that one is perceiving, episodic remembering carries information about its own memorial character. When we remember an event *p*, we 'know that we remember *p*' rather than just 'know that *p* occurred'. If remembering were merely a matter of reality monitoring, we would expect our memories to take the latter form – a kind of 'perception' of past events – rather than the former.

representations available to the human mind: (1) *imaginings of actual occurrences* (Munro, 2021a; b) and (2) *memories of past imaginations*.

In (1), one takes oneself to represent an actual occurrence even though one did not experience it oneself. Such imaginings of real events occur most commonly when one is exposed to others' testimony. In such contexts, one may generate 'vicarious memories' (Pillemer et al., 2015) – imaginings of what happened that one knows to be based on someone else's experience and not one's own. For example, research on 'socially shared retrieval induced forgetting' (e.g. Cuc et al., 2007; Hirst & Echterhoff, 2012) shows that when people listen to others' testimony, they may 'co-imagine' the narrated events. Thus, imaginings of actual past occurrences are ubiquitous and this ubiquity is due to the fact that humans communicate a lot about the past.

In (2), one takes oneself to have experienced something that did not actually occur. This case is illustrated particularly well through the phenomenon of 'non-believed memories' (Mazzoni et al., 2010). Non-believed memories are representations of events that have the phenomenological features of a memory (i.e., they 'feel' like a memory) but which one no longer believes to be 'real' (i.e., to have occurred). Such non-believed memories occur – for example – when one takes oneself to remember an event but has received convincing evidence that the event did not actually happen. Crucially, as Otgaar et al. (2014, p. 351) note, non-believed memories "are frequently accompanied by statements that the mental representation originated in another source (e.g., a dream)." In response to changing their belief about the occurrence of the event people continue to insist that they are *remembering something* – such as a dream or a past imagination. That is, people do not seem to change their belief that they are remembering but their belief about whether their memory is of an actual past occurrence (Mazzoni et al., 2014). This is noteworthy because it suggests that people having non-believed memories do not change their assessment of the *mnemicity* of the episode in question: if they did, they would take themselves to be *currently imagining* instead of remembering. Instead, they continue to take themselves to *remember* but change their assessment of the reality of the remembered event (for further evidence distinguishing mnemicity from other aspects of episodic representations, see Mahr & Schacter, 2022).

All of this provides support for the idea that there is a real psychological distinction to be drawn between processes monitoring whether an event actually occurred and processes monitoring whether one's current episodic representation is an outcome of one's own past

experience. However, note that while these processes produce *different judgments*, they clearly interact: in many cases, mnemicity attribution and reality monitoring go hand in hand, depend on each other, and likely use similar types of information. There are, nonetheless, clear conceptual and cognitive differences in *what* is being monitored in either case: mnemicity attribution concerns whether one is *currently remembering* and reality monitoring concerns whether *what one remembers actually occurred*.[2]

Who needs mnemicity?

Arguments, such as ours, that the cognitive distinction between remembering and imagining is the result of a dedicated judgment, are sometimes met with replies suggesting that no such judgment is necessary (e.g., Hoerl, 2014; Urmson, 1976). On the one hand, for example, Urmson (1976) has claimed that determining mnemicity need not involve any kind of mental judgment because it ought to be trivial: in order to know whether one is currently remembering one merely needs to know whether one *intended* to do so (see Michaelian, 2016 for discussion). After all, memories often do not come to mind spontaneously but as a result of an explicit intention to remember something. However, even disregarding the fact that a large proportion of human memories occur spontaneously and unintentionally (Berntsen, 2010), on the view we are proposing here, mnemicity is required in order to form the *intention to remember* in the first place. If one did not know how to distinguish between memory and imagination, one could also not form the intention to remember. This does not preclude that, without mnemicity, one might still use episodic simulation in a way that faithfully represents past occurrences since other intentions (such as to find out whether one performed or merely planned a certain action) might make this possible. However, without the ability to entertain mnemicity (and a corresponding concept of remembering), one could not form the intention to *remember* past occurrences (i.e., to construct representations of one's personal past experience).

On the other hand, one might wonder whether any kind of mnemicity attribution is necessary for the adaptive operation of an episodic simulation mechanism. One might worry that – in

[2] Accordingly, there is more to say about this distinction in terms of which mechanisms might underly each judgment. In particular, he development of mnemicity tracking likely also influences the way humans track reality. On our view, reality and mnemicity monitoring are tightly intertwined and only dissociate in specific circumstances (as in e.g., non-believed memories or vicarious memories). Even though these are edge-cases, they present the most promising avenues for studying the relationship between reality monitoring and mnemicity monitoring. Due to considerations of length, we cannot give a mechanistic account here.

contrast to reality monitoring – mnemicity attribution is essentially useless with regards to the functioning of episodic thought. Indeed, recent treatments of the functions of episodic simulation have focused on capacities that do not involve mnemicity. After all, episodic simulation is arguably adaptive not primarily because it allows one to recall past experiences but to flexibly construct simulations of future and other hypothetical experiences (Schacter et al., 2007; 2012). A major evolutionary root of the episodic simulation system is likely to be found in its capacity to support navigation (Buzsáki & Moser, 2013) and exploration (Hills et al., 2015; Hills & Butterfill, 2015): generating simulations of possible routes might support planning and decision making. For example, firing sequences in hippocampal place cells in rats have been shown to explore possible paths at decision points in an action-predictive manner (Johnson & Redish, 2007) including paths the rat had never taken before (Gupta et al., 2010).

Does this capacity necessitate the ability to monitor the origin of episodic simulations in previous experience? Hills & Butterfill (2015) provide one of the few treatments investigating the cognitive 'conditions of possibility' of (what we call) episodic simulation in animals. On their view, episodic simulation requires a primal concept of the 'self' allowing an animal "in updating behaviors and representations, [to] distinguish simulated actions and outcomes from their actual counterparts" (p. 376). Regardless of whether this capacity indeed requires the ability to track 'self' rather than 'reality', it amounts to what we call 'reality monitoring'.

Indeed, animals capable of episodic simulation (which likely includes at least all mammals, Mahr & Fischer, in press) require various forms of reality monitoring. Not only do they need to distinguish between their current perception of their environment and their current simulation of that environment (a form of *perceptual* reality monitoring a la Dijkstra et al., 2022) – they also need to keep apart previously made plans from previously carried out action (a form of *memorial* reality monitoring a la Johnson & Raye, 1981). For example, a rat planning a route to a reward would not want to confuse simulating obtaining a reward with actually obtaining it, nor would it want to confuse having simulated obtaining the reward with having already obtained it.

Rats (and animals with a similar simulation capacity), therefore, require the ability to make distinctions between simulations that allow them to determine which actions have already been performed and which ones have not. As we have argued above, however, neither of

these capacities amount to the ability to distinguish whether one is currently imagining or remembering. As we have emphasized throughout, judgments about whether a given mental simulation represents present or previous reality are distinct from judgments about whether one is remembering said reality – that is, whether one's current representation of that reality is an outcome of one's own experience or not.

In order to plan a route through a maze, it might be useful to simulate different possible paths. Such simulations will invariably draw on an animal's previous experiences. However, in order to efficiently generate such simulations all the animal needs to worry about is which simulated path is the best one to take. Could tracking the extent to which a given simulation recapitulates previous experience help in making this decision? For example, the extent to which a route is remembered rather than imagined might carry information about the extent to which one should rely on it (e.g., Tulving, 1985). However, while 'remember' judgments sometimes correlate with confidence judgments in humans (Geraci et al. 2009), assessing mnemicity is surely not the most efficient way to determine certainty. If all one cared about was confidence, why not monitor one's confidence directly (something that mammals seem to be perfectly capable of doing, Smith et al., 2014)? For an animal using episodic retrieval in the service of navigation mnemicity simply has no obvious function. While there is no space to do so here, the same conclusion could be motivated for the various other basic functions episodic simulation has been suggested to perform in other animals (e.g., temporal credit assignments or the computation of long-run action values, Foster & Wilson, 2006; Mattar & Daw, 2019): cognitive attributions of mnemicity do not feature in any of them.

Notably, this conclusion holds irrespective of the extent to which a given organism is capable of flexible episodic 'construction' or 'recombination'. Humans are capable of generating a huge array of imaginations by drawing on and flexibly recombining elements of their previous experiences (Schacter et al., 2007; Mahr, 2020). One might think that the extent to which an organism is capable of episodic construction (as opposed to the mere retrieval of previous experiences) predicts its need for assessments of mnemicity. The more fanciful one's imaginations can be, the more urgently one might be in need of a capacity to distinguish them from reality. Again, however, the required cognitive ability here is reality monitoring and not mnemicity attribution. As long as a system can assess the reality of its episodic constructions, it need not take into account whether it *personally experienced* those constructions.

As we have argued above, in humans, judgments of mnemicity and reality are dissociable: we can generate representations of reality that do not come from our own experience and representations of unreality that do. To the best of our knowledge, no such dissociations have yet been observed in other animals. This alone, of course, is no reason to deny non-human animals the capacity for mnemicity attribution. Reality monitoring itself has scarcely been a topic of investigation in comparative cognitive science. To make progress on this front, it would be useful to know whether other animals can entertain the same range of different kinds of episodic constructions that humans can (see Mahr, 2020) – for example, can non-human animals construct event representations they take to have actually occurred but which they did not experience themselves? Even though there is a lack of evidence on this front, we can nonetheless resort to functional reasoning. What would be the benefits for non-human animals of developing two separate monitoring capacities for reality and mnemicity? As we have argued here, mnemicity judgments do not seem to significantly contribute to the proposed evolved functions of episodic simulation in terms of planning and decision making.

This is not to say that other animals might not engage in forms of cognition that could be evolutionary pre-cursors to mnemicity judgments. Judgments of reality, familiarity, or confidence are all candidates here. However, given its conceptual complexity and lack of obvious utility for other animals, the null hypothesis in this case should be that determinations of mnemicity are human specific.

What does mnemicity do?

In view of its apparent lack of utility for the basic functions for which episodic simulation seems to have been selected, one might wonder, why do humans seem to represent mnemicity in addition to reality? What does the capacity to determine the mnemicity of episodic representations allow a cognitive system to do that it would not be able to do otherwise? What are the benefits of dissociating judgments of reality from judgments of personal experience?

As emphasized throughout, a “mnemicity + reality monitoring” architecture enables one to entertain novel kinds of episodic representations: imaginings of actual occurrences and remembered imaginings. What, however, are the benefits of being able to entertain these representations? On the view we are proposing, the capacity to represent mnemicity in addition to reality has two kinds of benefits: (1) benefits for communicative cognition, and (2) benefits for episodic cognition.

Regarding (1), consider a creature which receives all of its episodic knowledge (everything it knows about the past) from its own experience. For such a creature, there would be no use for tracking what it experienced in addition to what it should consider to be real: everything that 'really occurred' would by default have been personally experienced. Humans, however, are not creatures of this kind – we learn much (if not most) of what we know about the past from others and are constantly intentionally transmitting such information to others. For creatures like us, then, not everything we know to have 'really occurred' comes from our own experience – and not everything we experience (as in listening to someone else's testimony) necessarily represents something that really occurred.

Because so much of human knowledge comes from others, personal experience naturally gains special epistemic and social status (see Mahr & Csibra, 2021 for more on the mechanisms grounding this status). The epistemic and social benefits of tracking mnemicity for humans therefore mainly result from the highlighted status of personal experience in individual human cognition as well as social interaction. As a result, the capacity to keep apart what one personally experienced from what one considers to have actually occurred benefits humans both when receiving and when giving testimony.

On the receiver's side, mnemicity attribution enables one to 'quarantine' beliefs from contamination through other's testimony. If I believe that Ariel cheated on Ada because I was told by someone, I might be swayed more easily by Ariel's professions to the contrary than if I believed it based on my own experience. The capacity for 'imagining the actual' is particularly beneficial in this regard: it allows us to learn from others' testimony without confusing it with our own experiences.

On the sender's side, tracking mnemicity allows one to decide for which of our beliefs we have epistemic authority in virtue of having acquired them through personal experience (see Mahr & Csibra, 2018 for a detailed account). Indeed, in some sense it is only this capacity which allows one to truly 'give testimony' (since testimony is arguably by definition an account about the past based on one's own experience; Mahr & Csibra, 2020). All of this facilitates the coordination of beliefs about the past with other members of one's community (Mahr & Csibra, 2021).

This latter point is worth emphasizing because remembering the past is essential to many human social interactions. On the one hand, representations of the past ground social commitments and entitlements (Mahr & Csibra, 2020) and, thus, coordination about who and

how one has access to it is important. On the other hand, remembering the past communally coordinates representations of social and physical realities across people (Echterhoff et al., 2017) and supports the creation of individual and shared identities (Nelson & Fivush, 2020). These coordinative functions of remembering, enabled by mnemicity monitoring, are supported by the ability to track and broadcast when one can lay claim to epistemic authority grounded in personal experience (Mahr & Csibra, 2018; Craver, 2020). Claims such as "I was there" or "I witnessed this myself" carry weight due to the heightened status of personal experience for human beings.

Regarding (2), in addition to benefitting communicative cognition, the ability to conceptualize and monitor mnemicity also has consequences for episodic cognition – that is, for how one might use the ability to generate episodic representations in the first place. On the one hand, as Donald (2012) points out, one of the distinctive features of the human episodic memory system is its capacities for intentional retrieval. If one understands that some episodic representations are outcomes of one's past experiences whereas others are mere construction of such experiences, this arguably allows one to intend to generate one rather than the other kind of representation. In other words, as mentioned above, once one has developed the ability to monitor mnemicity, this should also allow an intention to remember in the sense of generating episodic representations based on *one's own* experiences. Of course, research on implicit memory (Schacter, 1987; Schacter et al., 1993) shows that in some instances (e.g., Nickel et al., 2015; for review, see Ryan & Shen, 2020) episodic memory is capable of accurately representing past events in support of judgment and decision making absent such intention. Indeed, absent a distinction between reality and mnemicity, one might still intend to construct episodes that accurately represent a given occurrence. Only with the distinction in place, however, will one be able to intentionally 'retrieve one's own past experiences'. As a result, the ability to form the intention to remember ought to improve the ability to encode and retrieve past experiences – not least by making it amendable to explicit learning, teaching, and the application of mnemonic strategies. The use of different encoding and retrieval strategies in particular has been found to contribute to interindividual variance in episodic and autobiographical memory proficiency (Kirchhoff, 2009; Kirchhoff & Buckner, 2006; Miller & Van Horn, 2007; Miller et al., 2012). On the other hand, as illustrated by 'remembered imaginings', the representation of mnemicity in addition to reality enables the metarepresentational embedding of different kinds of episodic representations. In remembered imaginings, two kinds of episodic representations are embedded, each with its

own judgment of reality (one remembers a 'real' imagination of something 'unreal'). In this way, the candidate contents for memory and imagination are expanded: one can not only remember and imagine events, but also other memories and imaginations. Consequently, the scope of episodic thought – what one can conceive of through memory and imagination – is dramatically increased.

In light of these considerations, let us briefly reflect on how our claim that mnemicity attribution is likely uniquely human might be experimentally evaluated. The capacity for mnemicity attribution should express itself primarily in the expanded scope of episodic representations a given cognitive system can entertain. Therefore, in evaluating the presence of mnemicity in other animals, what one should arguably test for is whether they can generate a similar range of episodic representations as humans. In particular, imaginings of actual past occurrences would necessitate mnemicity. However, it remains unclear in what context the ability for 'imagining the actual' would express itself without the ability for giving and receiving testimony. With this in mind, it is not surprising that we have evidence for mnemicity tracking in humans while the question never even occurred in research on non-human animals.

2. Cultural learning of mnemicity

Where does mnemicity come from? Through what developmental and evolutionary processes do humans become able consciously to distinguish memories from imaginings? Learning is bound to be a big part of the answer. The development of all traits – anatomical, morphological, physiological, and psychological – depends on input from the environment as well as genetically inherited information. But what kind of learning is important, and to what extent is the learning primed or constrained by genetic inheritance?

In principle, mnemicity could be Chomskyan. People may acquire mnemicity in the way that, according to Chomsky (1965), Pinker (1994) and others, we acquire the capacity to use language. In this case, learning would be highly constrained by a genetically inherited Mnemicity Acquisition Device (MAD). Input from knowledgeable others, people who already have mnemicity, would be necessary for development, but what could be learned from this input would be tightly controlled by the specialized learning device. For example, paralleling Universal Grammar in the linguistic domain, the MAD might dictate that a simulation be conceptualized as a memory when it exceeds certain thresholds of vividness and detail, and compel memories to be believed. On this Chomskyan or cognitive instinct

account, most of the input for learning would be asocial. The learner would tune up her capacity to distinguish memories and imaginings by introspection, engaging in a kind of perceptual learning with internally generated inputs. Cultural learning would play a minimal role. Input from other people would just supply linguistic labels – 'memory' and 'imagination' in English – and maybe adjust within narrow bounds the thresholds for using these terms in particular social contexts.

In contrast, our cognitive gadget hypothesis (Heyes 2018, 2019) suggests that cultural learning does the heavy lifting in the development of mnemicity. There are plenty of genetically inherited contributions, including the basic neurocognitive mechanisms of event simulation (Buzáski & Moser, 2013), but none of them have been specialized by natural selection for the development of mnemicity (see also, Jablonka, 2017). Introspection is important because the learner's first task is to distinguish among phenomenal experiences generated by event simulation. However, introspection will not yield mnemicity unless one possesses a concept of remembering, transmitted by local experts – people who acquired mnemicity earlier in their lives via cultural learning from a previous generation of experts. Both instinct and gadget accounts suggest that mnemicity is inherited, but the gadget hypothesis suggests that the inheritance is social rather than genetic, mediated by cultural learning rather than DNA.

Discrimination, interpretation, and broadcasting

The gadget hypothesis suggests that cultural learning builds the capacities for discrimination, interpretation, and broadcasting of mnemicity. The discrimination component assumes that phenomenal experiences – or, as we use the term, 'feelings' - do not come with labels indicating where they originated in the neurocognitive system. In much the same way that we learn to distinguish pairs of external visual (Schwiedrzik et al, 2011) or olfactory stimuli (Li et al, 2008) that were once subjectively identical, children learn to distinguish metacognitive feelings that indicate remembering from those that indicate imagining or knowing and from emotional, perceptual, and motoric experiences (Heyes et al., 2020). Adults enable this discrimination learning by putting children in situations where these feelings are anti-correlated or have distinctive sequelae. For example, when a child is asked to 'draw a cat' they are likely to experience more feelings of imagining and fewer feelings of remembering than when they are asked to 'draw a picture of the cat we saw this morning'. Similarly, in the game 'What did you change?', one player changes their hat, coat, or scarf while other

children's eyes are closed, and then, on opening their eyes, they guess which item was switched. In the guessing phase, a child may have experiences that they take to be feelings of remembering about the hat. If it turns out that it was the hat that changed, they get a teaching signal from the social environment, prompting them to adjust their 'bet' about how feelings of remembering differ from other phenomenal experiences.

Once a child has begun to discriminate feelings of remembering, their task is to work out what these feelings mean. Older individuals – who we can think of as 'mnemicity experts' – guide this interpretation task via conversation and expectation. Indeed, while such guidance is often likely to be unconscious, both parents and educators in Western samples also report intentionally encouraging remembering conversations and activities to support children's development (Kulkofsky & Koh, 2009; Van Bergen & Andrews, 2021). Looking at a child's picture of 'the cat we saw this morning', a parent might say 'He's got lovely ginger fur, but the cat we saw today didn't have black marks', indicating to the child that what she took for feelings of remembering were in fact feelings of imagining. Caregivers also provide names for feelings of different types, and query children's efforts at interpretation. 'Do you remember the color of his fur?' 'I think you're imagining that!' Furthermore, phrases like 'remember when', 'do you remember', and 'think back' crop up in different circumstances, and with different expectations, to words like 'imagine', 'pretend', 'dream up', and 'think up'. Reminiscing is a common family activity, not just when something interesting or important has happened recently but also as a form of bonding and sharing daily experiences with one another ("What happened at preschool?" "Do you remember who we met when we went to the shops?"; Nelson & Fivush, 2004; Salmon & Reese, 2016; Wareham & Salmon, 2006). Through such conversations, children are afforded opportunities to learn specific expectations about how remembering will be judged against certain standards and, therefore, what rules their own remembering should follow. Someone who remembers is expected to draw a cat of one color rather than another, to search for Cheerios in one kitchen cabinet rather than another, whereas the behavior of someone who imagines is less constrained and less subject to normative assessment.

Even the cognitive instinct account of mnemicity, which assumes that discrimination and interpretation are primarily 'in our genes', takes it that the development of broadcasting depends on cultural learning. I cannot tell you whether I am remembering or imagining without words, and the words must be learned from other people. However, the gadget perspective highlights that there is much more to broadcasting than using the right words. To

broadcast effectively, in a way that advances individual and collective goals, I need to learn coded rules for remembering within my social and cultural group (e.g., Craver, 2020). Such learning includes not only the circumstances, feelings, and behavior that accompany specific forms of remembering (interpretation), but also the conditions in which sharing one's recollections is allowed, required, forbidden, or credible. For example, is it appropriate to remember the deceased's misdemeanors at a funeral? Is a child allowed to remember something that contradicts an elder's testimony, and will this memory be treated as having merit? In my social group, are people more likely to believe me if I remember experiencing something first-hand or if it came to me in a vision? In addition to these normative dimensions of remembering, we learn through social interaction the kinds of broadcasting needed to combine our own episodic memories with those of others to make group-level, or suprapersonal (Shea et al., 2014) event simulations for decision-making. For example, do we give weight to speaker status and confidence or take a more democratic approach to negotiating a collective representation of the past? Is the only woman in a group of senior men more likely to get her vivid recollection into the group's event simulation if she is assertive or deferential in her claims to memory?

Other gadgets

The evidence discussed in the next section is suggestive of a gadget account of mnemicity. However, more broadly, the gadget account of mnemicity merits attention because it has recently emerged that other cognitive functions, once thought to be instincts, are highly dependent on cultural learning. For example, developmental, cross-cultural, and neuroscientific evidence now indicates that children learn to mentalize through conversation about the mind, unconstrained by a 'theory of mind module' (Heyes & Frith, 2014). Similarly, imitation, viewed since the 1970s as a cognitive instinct (Meltzoff & Moore, 1977), looks increasingly like a gadget. Recent studies undermine prior evidence of imitation in neonates, the foundation of the instinct view (Davis et al., 2021). They also indicate that social experience plays an inductive (Gottlieb, 1976), rather than a facilitative or 'tuning', role in the development of imitation. For example, training studies – involving adults, infants, and nonhuman animals – show that imitative ability can be forged, enhanced, abolished and reversed by novel patterns of sensorimotor experience (Catmur, Walsh & Heyes, 2009; Heyes & Catmur, 2021). If imitation was an instinct, merely tuned or triggered by experience, one would expect stabilizing selection to have buffered its development

against novel environmental inputs of this kind, inputs that could interfere with its adaptive function (Cosmides & Tooby, 1994; Pinker, 1997).

It is still not clear whether language is an instinct or a gadget, but the evidence is increasingly strong that the acquisition of syntax, as well as semantics, depends on cultural learning that is not constrained by a dedicated language acquisition device (Christiansen & Chater, 2016).

3. Evidence of cultural learning

Roughly speaking, we can differentiate three domains of evidence relevant to our gadget account: *development*, *teaching and training*, and *cultural variation*. Below we will consider evidence from each of these domains in turn.

Development

First, the cognitive gadget hypothesis predicts that mnemicity *develops* in ontogeny as a result of parental and communal scaffolding. More concretely, the cognitive gadget account of mnemicity predicts that there should be effects of social scaffolding on (1) children's capacity for intentional memory encoding and retrieval, (2) children's ability to track the sources of their beliefs (i.e., to distinguish what they know on the basis of their own experience from what they know based on other sources), and (3) children's ability to appropriately report that they are remembering.

Regarding (1), parents and others use a range of techniques to scaffold and support young children's emerging memory skills (Nelson & Fivush, 2004; 2020). For example, individual differences in mothers' reminiscing styles relate to children's concurrent and future memory skill and performance (Fivush et al., 2006; Reese et al., 1993; Salmon & Reese, 2016; Wareham & Salmon, 2006). Mothers who are more elaborative (asking open questions and providing narrative structure and detail) have children who come to remember their own experiences more richly, while mothers who are less elaborative (asking closed questions and providing scant detail) have children who remember their experiences with less detail and structure (see Waters et al., 2019; Wu & Jobson, 2019, for meta-analyses). Effects of maternal reminiscing style and content are also seen on children's deliberate memory strategy use, suggesting multiple lines of social influence on memory understanding and skill (Haden, Macus & Jant, 2019). Younger preschoolers with more elaborative mothers during reminiscing outperform their peers on an object memory task, for example, using more intentional memory encoding strategies during study (Langley, Coffman & Ornstein, 2017).

Similar benefits for deliberate memory are found for children whose mothers talk about memory and other mental state processes during reminiscing (Rudek & Haden, 2005), or who scaffold children's use of organizational memory strategies when studying a set of categorically related cards (Larkina, Güler, Kleinknecht, & Bauer, 2008). These studies support the idea that maternal interaction might scaffold children's ability to *intentionally* remember.

Regarding (2), individual differences in maternal reminiscing may also predict children's source understanding. In naturalistic research, Welch-Ross (1997) found associations between mothers' reminiscing style and their 4-year-old children's understanding of knowledge as experientially or non-experientially derived. Extending this work, Reese and Cleveland (2006) found both concurrent and longitudinal associations of maternal reminiscing with children's understanding of mind. Controlling for other theory of mind tasks, maternal elaborations and metamemory utterances at 40 and 51 months were each uniquely associated with children's understanding of the origins of knowledge at 51 months. Finally, in aligned research from Klemfuss et al. (2016), more elaborative parents had 4- to 7-year-old children who were better able to detect and resist false suggestions from their parents and from an experimenter about having committed a minor transgression during play. While children's resistance to false suggestions was above chance, more than half answered incorrectly to at least one parent suggestion. When an unfamiliar experimenter instead made false suggestions, an average of two in six suggestions were erroneously supported (ranging up to six). The benefit of parental elaboration for children's rejection of false suggestions emerged over and above children's working memory, theory of mind, and inhibitory control, suggesting a role for parent socialization practices in shaping children's discriminative capacities when remembering. Interestingly, and further supporting the potential role of sociocultural learning pathways, age was not a predictor of performance once parental elaboration and child working memory were entered.

Complementing these naturalistic observations, experimental research shows that it is possible to guide children's interpretation of their episodic representations using conversational prompts. For example, Ghetti et al. (2006) allocated 6- to 10-year-old children to one of three conditions: control, source monitoring training, or memorability training. Those in the memorability condition were encouraged to reject a non-experienced event (e.g. brushing hair), because "you would remember it", while those in the source monitoring condition were told "we only talked about it". Children in the memorability condition - but

not the source monitoring condition - were better at rejecting incorrect suggestions on subsequent memory tasks.

Regarding (3), cultural learning may shape when and how children report that they are remembering as well the phenomenology they report when doing so. Even though reality monitoring and mnemicity are distinct cognitive skills, some developmental research that is billed as investigating 'reality monitoring' can provide information about the development of mnemicity. Such research suggests that children acquire the capacity to make mnemicity determinations relatively late. For example, Sluzenski et al. (2004) found that while even 4-6-year-olds more often retrieved experienced than imagined events, they were markedly worse at correctly categorizing these events than 6-8 year-old children. Such developmental differences in reality monitoring performance were partly explained by the fact that younger children were unable to appropriately interpret the phenomenal qualities of their episodic representations. In fact, younger children showed an *internalization bias* (i.e. tending to take real events to have been imagined), whereas older children and adults tend to *externalize* episodic simulations (i.e. falsely take their imaginations to represent past experiences; Kwon et al., 2021).

In the few developmental studies that have explicitly investigated the phenomenology of remembering in children – children as young as age 6 were already able to differentiate remembering from familiarity (Brainerd et al., 2004; Ghetti & Angeli, 2008; Ghetti et al., 2011). However, this strand of research has so far failed to test pre-schoolers which makes it hard to draw conclusions about the nature of the development of recollective phenomenology from this data. After all, at age 6, children have already undergone substantial cultural learning. Indeed, even though recollective phenomenology seems to be present before the school years to some extent, it substantially develops throughout the school years. In one study (Brainerd et al., 2004), 14 year-olds seemed to experience recollective phenomenology 2-3 times as often as 7-year-olds. Further, this kind of phenomenology seems to be intimately linked to children's metamemory capacities which respond to training and instruction of the kind likely to be provided by parents in the context of joint reminiscing (Ghetti et al., 2011).

Finally, there are signs that the suggestibility of children's memory is due not only to immature reality monitoring, but to uncertainty about social norms relating to claims about the past. Whereas (Western) adults' concept of mnemicity dictates that one can make mnemonic claims only about parts of the past one has experienced oneself, for example,

younger children might not yet understand this constraint. Consistent with this possibility, Johnson and Wellman (1980) suggest that 4-5-year-olds are not yet able to distinguish uses of 'remember', 'know', and 'guess'. Over and above reality monitoring deficits, this limitation can explain why young children incorporate more information acquired by second-hand reports or inference into their memory reports than adults do. Indeed, natural conversation about the past has been shown to 'contaminate' children's ability to provide eye-witness testimony to a much greater extent than in adults (e.g., Principe & Schindewolf, 2012). Crucially, Pool & Lindsay (2006) showed that when given a 'source monitoring training' procedure, in which it is highlighted to children that they should only report as remembered what they saw themselves, 7- 8-year-olds produced fewer misinformation errors.

Training and intervention research

There are good reasons to think that 'feelings of remembering' (e.g., Perrin et al., 2020) – like other metacognitive feelings (e.g., Alter & Oppenheimer, 2009; Koriat & Levy-Sodat, 1999) – are the product of the *learned interpretation* of phenomenal qualities. On the gadget account, the interpretation of such feelings underlying mnemicity determination should also be sensitive to *teaching and training*. It is well known that memory can be trained and that the explicit teaching of encoding, retrieval, and meta-memory strategies is a common feature of Western education (Bjork, 1994). Indeed, as mentioned above, a large share of the inter-individual differences in mnemonic competence is arguably due to *memory skill* which is affected by socialization and instruction. Such interindividual differences are also observed in reality monitoring abilities (Buda et al., 2012).

A handful of past intervention studies show good success in enhancing parents' reminiscing style to include greater elaboration (Reese & Newcombe, 2007; Valentino et al., 2013; Van Bergen et al., 2009; Taumoepeau & Reese, 2013), and outcomes are promising. After one year (from age 2.5 to age 3.5), for example, greater memory elaboration is observed for intervention children when talking independently with an experimenter, and greater memory accuracy is seen for intervention children who also show high self-awareness (Reese & Newcombe, 2007). Moreover, greater contextual and thematic memory coherence is seen for intervention children who were asked later at age 11 to report a low point from their life (Reese, Macfarlane, McAnally, Robertson, & Taumoepeau, 2020) suggesting a causal relationship between early developmental scaffolding and long-term memory outcomes.

Acquiring mnemicity might not only benefit *mnemonic*, but also *imaginative* capacities. After all, learning about the multiple ways in which memories can differ from imagination in their relationship to world and mind (see Mahr, 2020; Michaelian, 2016) might allow one to more effectively employ one's imagination in these different ways. In line with this idea, several findings suggest that children's *imaginative* capacities benefit from social scaffolding. In particular, Harris (2021) has argued that the common assumption that children have a particularly rich imagination is misguided. Notwithstanding their preference for play, children's imagination seems to start out as being fundamentally reality-oriented. From the perspective presented here, this is indeed unsurprising – absent a distinction between memory and imagination, episodic simulations are likely instead differentiated according to their relationship to reality. For example, while already 2-year-olds can aim to depict 'reality' in their drawings, even children as old as 8 years of age often fail when asked to draw something that does not exist. Crucially, however, external scaffolding and cueing by adults can help children to succeed in such tasks (Harris, 2020). Similarly, Chernyak et al. (2017) showed that prospective imagination is also sensitive to social training: in their study, children who were asked to talk for 5 minutes about events in various temporal distances to the present displayed better planning and prospective memory performance. While it remains unclear to what extent such benefits are driven by the acquisition of mnemicity as such, they nonetheless provide an indication that cultural learning can fundamentally shape the way children learn to utilize the capacities of their episodic simulation system.

Even in adulthood, training can enhance metacognitive processes relevant to mnemicity. In one notable study, Rademaker and Pearson (2012) tested whether mental imagery training would improve the ability to report imagery vividness as measured by the extent to which a given mental image influenced a binocular rivalry task. They found that such training improved participants' ability to accurately report imagery vividness while leaving the strength of vividness itself (as measured through binocular rivalry effects) unaffected.

Moreover, ethnographic research suggests that reality monitoring processes themselves might be sensitive to training and teaching. For example, Noll (1985) reports that in some societies, particularly those with magico-religious tradition, the visions of Shamans are cultivated via specific training processes to enhance access and vividness of mental imagery. In cognitive terms, shamanic training seems to consist to a large extent in cultivating one's reality monitoring processes in such a way as to produce epistemically laden, religious experiences.

Such visions may be used as mnemonics, particularly when large amounts of cultural information must be memorized and orally transmitted.

Cultural variation

The evidence reviewed so far mostly concerns WEIRD populations (Henrich et al., 2010). However, there are likely to be important *differences between cultures* that could impact how mnemicity is learned and taught. For example, there might be cultural variation in the norms regulating when it is appropriate to claim to remember an event or in how important mental states are viewed to be in generating behavior. Therefore, a third line of research supporting our cultural learning hypothesis comes from the cultural comparison literature and ethnography. No research to date directly compares the socialization of mnemicity across different cultural contexts. However, a series of developmental studies show mnemicity-relevant cultural variation in how parents interact with their children. American mothers are more likely to co-construct memories with their 3-year-old children, for example, focusing on their child's perspectives, while Chinese mothers are more likely to repeat factual questions to children and focus on behavioral norms (Wang, Leichtman & Davies, 2010; also see Han, Leichtman & Wang, 1998).

Western adults are in turn more likely to tell elaborative, self-referential memories while Asian adults are more likely to make references to others (Jobson & O'Kearney, 2008). By age six, differences also emerge in children's treatment of memory accuracy. Six months following a staged 'visit to the pretend zoo' event, European American 6-year-olds report more inaccurate memory details than do Chinese American 6-year-olds (Klemfuss & Wang, 2017). These findings suggest that Western cultures are more likely to prioritize good storytelling over memory accuracy (see Kulkofsky et al., 2011, for findings that children instructed to tell an entertaining memory story are also less accurate), a bias with significant potential to shift the boundary between remembering and imagining.

In line with this idea, Wang et al. (2021) recently found that (in a Deese-Roediger/McDermott false memory task; Deese, 1959; Roediger & McDermott, 1995) European adults produced more 'remember' responses for non-presented (but semantically associated) lures than Chinese adults did. This suggests that Chinese participants might have employed stricter criteria for mnemicity determination and report (Koriat & Goldsmith, 1996) than Westerners did. Indeed, Paige et al. (2017) and Leger and Gutchess (2021) found that East Asians employed more stringent response criteria relative to North Americans in

recognition memory tasks. This conclusion is also supported by evidence from cross-cultural research on eyewitness testimony, suggesting that people from collectivist cultures tend to 'under-report' details compared to people from individualistic ones (for review, see Hope et al., 2022). For example, in a 'mock-witness' study, Anakwah et al. (2020a) compared free-recall reports from people in Ghana and the Netherlands (matched for educational achievement) and found that Ghanaians reported significantly fewer details. In a follow up study, Anakwah et al. (2020b) found that this tendency for underreporting was sensitive to enculturation: migrants from sub-Saharan Africa who lived in Western Europe reported more details in a similar free recall task than did sub-Saharan Africans living in Africa. While these findings are consistent with the idea that cultural norms might shape mnemicity determination (i.e., what people take themselves to remember), they could also be due to differences in cultural norms regulating memory *report* (i.e., what people deem appropriate to report, see Liu, 2016) or a combination of these factors. Finally, some of these effects might be explained by differences in encoding processes rather than differences in how memories are retrieved. Future research should therefore seek to disentangle these possibilities.

Ethnographic research also reveals marked cultural differences in the frequency and experience of a range of mnemicity-relevant phenomena such as hallucinations (Bauer et al., 2010; Luhrmann, 2011) and dreams (Lohmann, 2020). This variation can also be attributed to social learning. Luhrmann et al. (2021) adopt the term 'porosity' to describe a key cognitive difference in the ways in which people both across and within cultures understand the boundary between the mind and the world. A porous boundary between the mind and the world, more commonly endorsed outside Western societies, is one in which thoughts, feelings, and knowledge from outside sources can be directly experienced (e.g. from a higher deity or spiritual presence; telepathy; see Luhrmann et al., 2011, 2021; Taylor, 2007). Across four studies, Luhrmann et al. (2021) showed that those with higher porosity beliefs were more likely to report having personally experienced spiritual presence events. In ethnographic work with the Asabano people of Papua New Guinea, Lohmann (2020) similarly describes how dreams are taken as memorial evidence for a range of cultural beliefs: influencing or directing future behavior in much the same way memories do in other cultures (Alea & Bluck, 2003).

In the case of hallucinations, Luhrmann (2011) suggests two mechanisms underpinning cultural differences. People come to represent the mind in ways that are consistent with the mental representations of others in their communities, and they are explicitly encouraged to

use their minds in similar ways to others. Members of charismatic religious communities that encourage introspection and 'interiority' are therefore more likely to report having heard God speak directly to them, despite no external material source for the experience (Luhrmann, 2011). These same mechanisms can be seen in the case of visionaries. Newman (2005) describes the case of medieval monks and nuns enculturated into disciplines in which extrasensory visions were both possible and desirable, drawn not from imagination but from God, and cultivated via specific taught rituals and techniques.

4. Future Directions

The evidence discussed above is largely supportive of a gadget account of mnemicity: parents strongly scaffold their children's use of episodic representations, and such scaffolding seems to affect and support children's skills in discriminating and making use of different kinds of simulations. Moreover, not only is memory subject to training and teaching, so is the discrimination between different kinds of episodic representations. Finally, there seem to be cultural differences in how episodic representations are viewed as relating to reality and how this relationship is taught and trained.

However, while this evidence supports our claim that the gadget hypothesis of mnemicity merits consideration, there are as yet no direct tests of its central claims. Moreover, most existing research has focused either on memory abilities or reality monitoring rather than mnemicity itself. In general, questions about the origins of mnemicity are commonly not asked as explicitly as they need to be. Here, we therefore want to point to some open questions the investigation of which could provide or undermine support for our theory and advance the study of mnemicity more generally.

First, the gadget view anticipates that people from different cultural backgrounds will (1) have different concepts of remembering, (2) accept claims to remembering as authentic that might in other societies count as false memories or mere imaginations (e.g., Dranseika, 2020), and (3) show differences in the relevant metacognitive attribution processes that drive mnemicity detection. Indeed, investigating cultural differences regarding mnemicity will likely have practical implications for legal psychology (Hope et al., 2022).

So far, to the best of our knowledge, there is little research on what concept of mnemicity WEIRD people might have, whether this concept differs cross-culturally and/or throughout

history, and whether such conceptual differences might go along with differences in how mnemicity is determined cognitively and socially. One source of evidence about what the Western folk concept of mnemicity might look like comes from the intuitions driving the conceptual analysis of remembering in analytic philosophy (see, e.g., Rini, 2015, for how philosophical intuitions might serve as data in cognitive science). Here, the 'Causal Theory' (Martin & Deutscher, 1966) has been the majority view for over half a century (Bernecker, 2009). On this view, remembering has three central necessary conditions (1) factivity (the event must have occurred), (2) prior experience (the remembering subject must have personally experienced the event), and (3) causality (the subject's current event representation must have been appropriately caused by their past experience of the event). As yet, it remains unclear to what extent the Causal Theory is an appropriate description of WEIRD people's folk theory of remembering, whether it differs across cultures, and how such a folk theory relates to people's practices of cognitively and socially distinguishing memory from imagination.

Moreover, ethnographic research has – to the best of our knowledge – barely considered mnemicity. Most relevant work so far has instead focused on various versions of reality monitoring. While the results of this work are highly relevant to understanding mnemicity, as we have emphasized throughout, reality monitoring and mnemicity are not the same cognitive function. In order to get a better understanding of the depth and consequences of potential cultural differences in how people from different cultures view the relationship between memory, imagination, experience, and reality, ethnographic research will be essential.

Second, the work reviewed above shows that the metacognitive processes relevant to mnemicity can be either socially scaffolded or taught and that children generally have access to the kinds of social interactions that would provide them the opportunity to acquire mnemicity from others. Nonetheless, we are still lacking evidence directly testing the extent to which mnemicity is indeed culturally learned. To do so would require more closely tracking how children indeed acquire mnemicity. Instead, most research has looked at the development and parental scaffolding of reality monitoring capacities. For example, so far only one intervention study focuses on social scaffolding effects on children's understanding of mind (Taumoepeau & Reese, 2013), finding benefits for children in the elaborative intervention condition who initially had lower language skill. Because the study collapses across six theory of mind tasks, however, it is not possible to separate children's

understanding of conflicting representations from their understandings of the origins of knowledge. Given evidence that mothers report reminiscing with their children for a range of specific purposes, including the development of memory and other cognitive skills (Kulkofsky & Ko, 2009; Kulkofsky et al., 2009), parents are likely to be receptive to future intervention training of this kind more directly targeted at mnemicity. Thus, to more directly assess the gadget hypothesis of mnemicity, research in this vein should directly target children's ability to distinguish whether they are currently remembering or imagining.

Finally, there are as yet no experimental studies directly investigating the effects of teaching on the discrimination between memory and imagination. Ethnographic work has shown that such discriminations are indeed subject to teaching in many contexts (such as shamanic training). However, direct experimental evidence is still lacking. In particular, intervention studies with children might be telling with respect to how malleable mnemicity is in response to social input.

However, adults, who already possess a full-fledged capacity to determine mnemicity might also be sensitive to guidance in this respect – for example, explicit teaching might result in conceptual and cognitive change regarding the way memories are discriminated from imaginations. It has been shown that the metacognitive interpretation of phenomenal feelings in recognition memory tasks (e.g., of cognitive fluency as indicating item familiarity) is learned (Unkelbach, 2006; Briñol et al., 2006; Olds & Westermann, 2012; Geurten & Willems, 2017). It remains unclear, however, to what extent such interpretations are sensitive to scaffolding and teaching from others.

Conclusion

Questions about the mechanisms, development, and evolutionary origins of mnemicity ought to play a more central role in research on episodic simulation. Research in this domain has often been driven by tacit assumptions about how people discriminate between different forms of simulation. Here, we have tried to bring these assumptions out of the shadows and to show that the nature and origins of mnemicity are an important open frontier for research on episodic memory and imagination.

Taking a step over this frontier, we have proposed that – rather than being shaped primarily by genetic evolution – mnemicity is culturally learned. Several lines of research lend credence to this idea, but more research of specified kinds is needed both to assess the

cognitive gadget account of mnemicity, and, more broadly, to tell us how and why humans distinguish memory and imagination.

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