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# Do animals have episodic memory?

Alexandria Boyle [1, 2]
[1] University of Bonn, Center for Science and Thought
2 University of Cambridge, Leverhulme Centre for the Future of Intelligence

## 1. Introduction

Episodic memory is memory for personally experienced past events – that is, events which were experienced or witnessed first-hand. It's often contrasted with semantic memory, which is a store of decontextualized information. If I remember taking a picnic on a frosty day on Dartmoor, I'm episodically remembering. If I remember that Devon is the only English county with two coastlines, but don't retrieve any event associated with that information, I'm semantically remembering.

Whether animals have episodic memory is a subject of some controversy.[1] On the one hand, two decades of research into this question have turned up dozens of results apparently confirming that animals remember past events (to be discussed in more detail in §2). As a result, many comparative psychologists think that episodic memory exists in at least some nonhuman species (Allen & Fortin, 2013; Emery & Clayton, 2004; Jozet-Alves et al., 2013). I'll call this position 'optimism'. On the other hand there remain those I'll call 'sceptics', who propose that episodic memory is a uniquely human capacity. Some sceptics argue that the available evidence fails to show that animals have anything like episodic memory: it provides no reason to think that animals remember past events (Hoerl & McCormack, 2019; Suddendorf & Corballis, 2007). Nazim Keven (in this volume) calls this position 'capacity scepticism'. But in this chapter, I want to focus on a different form of scepticism, which I'll name 'kind scepticism'. A kind sceptic acknowledges that the evidence suggests animals have something *similar* to episodic memory – they have some form of memory for events. Nevertheless, the kind sceptic argues, this memory capacity does not qualify as episodic memory, because it *differs in kind*.

I begin in §2 and 3 by introducing optimism and kind scepticism in more detail. In §4, I'll offer a diagnosis of the dispute between kind sceptics and optimists. I suggest that this disagreement is not primarily about whether there are differences between human and nonhuman memory. Rather, it is about what episodic memory is, and what it would take for animals to have it. In §5, I consider how we might make progress. I argue that questions about the delineation of episodic memory can be settled by reference to the theoretical goals we aim to satisfy by asking whether animals have it. Since we ask whether animals have episodic memory in the service of a number of projects, the resulting picture is a pluralist one: different projects demand different delineations of episodic memory and can be expected to yield different verdicts about whether animals have it.

## 2. Optimism

Optimism, as I've said, is the view that animals have episodic memory. In this section, I'll give a brief overview of the evidence optimists take to support their view.

[1] I use 'animals' as shorthand for 'nonhuman animals'.

The pioneering studies on episodic memory in animals were conducted by Nicola Clayton and Anthony Dickinson (Clayton & Dickinson, 1998, 1999), who investigated whether Californian scrub-jays were able to remember past events using the 'what-where-when' criterion – which looks at whether animals recall *what* happened, *where* it happened, and *when* it happened (Tulving, 1972). In one experiment (Clayton & Dickinson, 1999, experiment 1), birds were allowed to cache worms and nuts at approximately the same time. They were then allowed to return to the caching site after either a 4- or 124-hour interval, during which the food had been removed to eliminate olfactory cues. All else equal, scrub-jays prefer worms to nuts – so one might expect the scrub-jays to prefer to return to the worms' location. But worms decay faster than nuts; after 4 hours they would still be fresh, but after 124 hours they would be unpalatable. The birds had been familiarised with these differential patterns of decay. So, if they were able to remember not just what was buried where, but *when* the food had been buried, they should display a preference for the worms' location after 4 hours, but for the nuts' location after 124 hours. This pattern was, indeed, observed.

The 'what-where-when' criterion is still widely used as an indicator of episodic memory in animals, but a number of additional criteria have also been used to investigate animals' memory for events. These include:

- Integration (Clayton, Bussey, et al., 2003): this criterion requires 'what', 'where' and 'when' components to be integrated into a single representation of the event, such that retrieval of one of these pieces of information about an event predicts retrieval of the others, and similar events can be discriminated from one another in memory.
- Flexibility (Clayton, Yu, et al., 2003): according to this criterion, the subject should be able to use the memory flexibly: rather than always producing the same behaviour, it should support a range of appropriate behaviour in different informational and motivational contexts.
- What-where-which (Eacott et al., 2005): this criterion replaces the 'when' component with a 'which' component. The idea is that one need not be able to locate an event in time to episodically remember it, but one should be able to discriminate it from other, similar events.
- Source memory (Crystal et al., 2013): this criterion investigates whether subjects recall other contextual information besides 'what-where-when' or 'what-where-which'. For example, Crystal et al. (2013) looked at whether rats could remember whether they found their own way to a location, or were placed there by an experimenter.
- Replay (Panoz-Brown et al., 2018): this criterion looks at whether subjects remember the order in which events occurred. For instance, Panoz-Brown et al. investigate whether rats can recall the order in which a series of odours were presented.
- Incidental encoding (Singer & Zentall, 2007): on this criterion, the subject should be able to recall information which, at the time of the event, she was not expecting to need, and which she has not previously been rewarded for remembering. This criterion aims to discriminate episodic memory from semantic or rule-based memory.
- Hippocampal dependence (Crystal et al., 2013): this criterion looks at whether, in species with a hippocampus, hippocampal lesions impair performance on episodic memory tasks – as they would in humans.

Researchers have looked for episodic memory in a range of animals besides scrub-jays, using some or all of these criteria. Confirmatory results have been reported relative to at least one of these criteria in great apes (Martin-Ordas et al., 2010), black-capped chickadees

(Feeney et al., 2009), magpies (Zinkivskay et al., 2009), rats (Babb & Crystal, 2006), dogs (Fugazza et al., 2016), meadow-voles (Ferkin et al., 2008), honeybees (Pahl et al., 2007), cuttlefish (Jozet-Alves et al., 2013) and Yucatan minipigs (Kouwenberg et al., 2009), among other species. Some of these species have only been tested using one or two of these criteria, whilst others have 'passed' tests using multiple criteria. Perhaps the most impressive evidence comes from rats, which have 'passed' tests employing what-where-when (Babb & Crystal, 2006), source memory (Crystal et al., 2013; Crystal & Alford, 2014), replay (Panoz-Brown et al., 2018), integration (Crystal & Smith, 2014) and hippocampal dependence (Crystal et al., 2013; Panoz-Brown et al., 2018) criteria.

This growing body of research has convinced many researchers that at least some nonhuman animals have episodic memory. Within optimism, a range of views about episodic memory's distribution and origins are represented. For instance, Timothy Allen & Norbert Fortin write that 'the core properties of episodic memory are present across mammals, as well as in a number of bird species' (2013, p. 10384), proposing that this is likely to be due to a 'shared underlying neural ancestry' (ibid. p. 10379). Others propose that episodic memory has emerged convergently in a number of lineages (Emery & Clayton, 2004; Jozet-Alves et al., 2013).

One caveat is worth noting. Most optimists stop short of claiming that nonhuman animals have episodic memory, preferring the term 'episodic-like memory'. This is because episodic memory is often characterised in terms of a distinctive experience of 'mentally reliving' a past event. Many take it to be impossible to determine whether animals have these experiences (e.g. Clayton & Dickinson, 2010; Michaelian & Sutton, 2017). The term 'episodic-like memory' is used as a way of side-stepping this issue: it is intended to indicate neutrality about whether nonhuman memories have the relevant experiential features. This is an important issue, which I have discussed at length elsewhere (2019). For the purposes of this chapter I set it aside. The dispute I'm concerned with in this chapter does not centrally turn on whether animals have *experiences* of mental reliving. As I outline below, the kind sceptics discussed here resist optimism on the grounds that human and nonhuman memory capacities may differ in *other* important respects, in virtue of which they may differ in kind.

## 3. Kind Scepticism

As I noted above, some – 'capacity sceptics' – dispute whether the evidence briefly described above establishes that animals have any form of event memory. In this chapter, however, my focus is not capacity scepticism, but *kind* scepticism. Kind sceptics argue that whilst the evidence may establish that animals have an event memory capacity *similar* to episodic memory, it does not establish that animals actually *have* episodic memory. This is because the relevant nonhuman memory capacities differ in kind from episodic memory, or because it is at least consistent with our evidence that they do.

What might it mean to say that animals' memory capacities may differ in kind from episodic memory? A popular view of science treats it as being in the business of investigating *natural kinds* – that is, groups of entities about which we can uncover laws or regularities, where those groups are 'natural' in the sense of being out there in the world to be discovered. Examples of natural kinds include gold, *Homo sapiens*, SARS-CoV-2 and haemoglobin: each seems to be a natural group about which we might discover regularities or laws.

Exactly what natural kinds are is subject of debate. One influential view treats natural kinds as homeostatic property cluster kinds (Boyd, 1989, 1991). A class C of entities is a homeostatic property cluster (HPC) kind if it satisfies the following conditions:

1. The members of C tend to share a cluster of properties;
2. That cluster of properties is methodologically significant, in the sense that it features in successful explanations, interventions and predictions;
3. There exist one or more 'homeostatic mechanisms' that explain why the cluster of properties tend to be found together in the members of C; and
4. C is 'maximal' with respect to its methodological significance –there is no group of entities C' which is more inclusive than C and has the same methodological significance as C (supporting all the same predictions, explanations and so on).

The HPC view is a popular approach to cognitive kinds – that is, the kinds investigated by the cognitive sciences, which might include things like emotions (Griffiths, 2013), concepts (Machery, 2009) and – importantly for our purposes – episodic memory (Andonovski, 2018; Cheng & Werning, 2016).There may be different ways to apply the HPC view to cognitive kinds, but one natural approach is to treat the cluster of properties characterising a cognitive kind in *functional* terms (in terms of the role that the cognitive kind occupies in individuals' mental lives), and the homeostatic mechanisms in *neurobiological terms* (in terms of the brain mechanisms that explain why those functional features arise and cluster together). In what follows, I'll assume this picture of cognitive kinds.

This provides two ways in which animals' memory capacities might differ in kind from episodic memory. First, it might be that although they're similar in some ways, they differ in some important *functional* respect. That is, they do not behave in the same ways, or play the same roles in animals' cognitive lives. Second, it might be that although they are functionally similar, they are underpinned by distinct neurobiological mechanisms. Kind sceptical views about nonhuman memory come in both of these flavours.

On the functional side, Keven (Keven, 2016, 2018) proposes that whilst animals form perceptual memories of events, these memories lack the structure characteristic of humans' episodic memories. Episodic memories, on his view, are characterised by temporal, causal and teleological structure: they carry information about the order in which events occurred, the causal relationships between events, and their relationships to the subject's aims or goals. Keven proposes that in humans, a 'narrative binding process' organises perceptual, image-like event memories into these temporally, causally and teleologically structured episodic memories. Animals, lacking language, plausibly lack this capacity for narrative binding – and whilst it's possible that another process might provide nonhuman memories with the relevant kinds of structure, Keven argues (in this volume) that there are independent reasons to doubt that nonhumans do have temporally, causally and teleologically structured memories. On his view, the nonhuman memories being uncovered in comparative psychology belong to a distinct cognitive kind, which he calls 'event memory'.[2]

On the mechanistic side, Sara Malanowski (Malanowski, 2016) has argued that establishing that animals have episodic memory requires showing that their memory capacities are underpinned by the same kind of neurobiological mechanisms as episodic memory. Malanowski sees this as key to the episodic memory research programme realising what she takes to be its central aim –increasing our understanding of and ability to treat human episodic memory pathologies. As Malanowski points out, experiments investigating nonhuman *behaviour* are not obviously capable of establishing similarity at the level of mechanism.

[2] Mahr and Csibra (Mahr & Csibra, 2018) also draw a distinction between episodic and event memory, proposing that animals have only the latter. Their distinction differs from Keven's, but space prohibits a full discussion.

Moreover, although lesion studies have shown that rats' performance in episodic memory tasks is impaired by hippocampal damage, and although we have evidence for mechanistic similarities between the hippocampi of rats and humans (Corballis, 2013), this does not show that the underlying mechanisms are the same – since the mechanisms may still differ when considered at a finer level of grain (Malanowski, 2016). So, even if rats or other animals have hippocampally dependent event memories, their memories may nevertheless differ mechanistically from our episodic memories, and therefore differ in kind.[3]

## 4. What Is Episodic Memory?

How should we make sense of the dispute between kind sceptics and optimists? Both of the kind sceptical views I've described involve an inference of the following shape:

> **P1**: There are certain differences between nonhuman memory systems and human episodic memory (or at least, this is consistent with our evidence).
> --
> **C**: Nonhumans lack episodic memory (or this is at least consistent with our evidence).

Understood in this way, we can locate the disagreement between kind sceptics and optimists in either of two places. It may be that optimists dispute that animals' memories differ from episodic memories in the ways kind sceptics claim. Or it may be that they dispute the legitimacy of the inference from P1 to C. In this section, I want to suggest that the disagreement is (at least primarily) concerned with the legitimacy of this inference – that is, it is about whether the differences identified by kind sceptics *make* the difference between a memory capacity 'counting' or 'not counting' as episodic memory.

It's important to distinguish this question from another, related question. The other question is: if human and nonhuman memory differ in the ways kind sceptics suggest, would that establish that the two differ in kind? Importantly, the answer to this question might be 'yes', without that showing that animals lack episodic memory – because there might be different kinds of episodic memory. Consider anatomical structures which are shared across species, such as the heart. It seems plausible to say, for instance, that the hearts of humans and zebrafish differ in kind – that *human heart* is one natural kind and *zebrafish heart* is another. Each of these plausibly satisfies conditions 1-4 above, and each is maximal with respect to a particular sphere of methodological significance. There are important generalisations or laws that are true of human hearts and not zebrafish hearts, and vice versa. For instance, the human heart has four chambers, whereas the heart of a zebrafish has only two. But that there is a difference in kind between human hearts and zebrafish hearts does not show that zebrafish do not have hearts – since both human and zebrafish hearts may belong to the more inclusive kind, *heart,* which also satisfies conditions 1-4 and has its own methodological significance. More generally, establishing that two things differ in kind does not show that they aren't both members of a specific kind with which we're concerned.

Our question, then, is about which kind we're interested in. When we ask whether animals have episodic memory, what cognitive kind is 'episodic memory' supposed to pick out? And how is this kind to be delineated? What functional properties and mechanistic

[3] Malanowski also doubts that the evidence establishes that animals have a form of memory functionally similar to human episodic memory. For the purposes of this short chapter, I focus only on her arguments about mechanism.

underpinnings does a memory capacity need to have in order to 'count' as a member of that kind?

These questions are not straightforward, because the comparative context in which they are asked vitiates certain natural ways of settling them. Suppose, for instance, that we discover a new species of duck, and we're interested in characterising the natural kind to which it belongs. Simplifying somewhat, we might begin by looking at the ducks we take to be typical or paradigmatic members of this new species, based on our observations to date. Of these ducks, we might ask: what do they have in common? What features do they tend to have in common, and by what mechanisms are these clustering properties underpinned? In this way, we might arrive at a characterisation of the kind, in terms of its properties and underlying mechanisms. Now suppose we want to settle the question of whether a new duck we've observed belongs to this species. We might naturally use the characterisation of the kind we've arrived at to address that question, by investigating whether the new duck has the relevant properties, underpinned by the relevant mechanisms.[4]

In the case with which we're concerned, however, this approach is problematic. We are interested in the proper characterisation of the kind episodic memory, a cognitive capacity whose only clear, uncontroversial instances are found in humans. So, our initial characterisation of the capacity will inevitably be based on what's known about the functional features and mechanistic underpinnings of episodic memory *in humans.* Yet it's reasonable to think that, if episodic memory is a capacity shared across species, there may be species-specific aspects to its manifestation – just as there are interspecific variations in the anatomy of the heart. An investigation into the functional properties and mechanistic underpinnings of episodic memory based only on its human instances might yield an adequate characterisation of *human* episodic memory. But we cannot unproblematically assess whether a candidate *nonhuman* memory capacity 'counts' as an instance of episodic memory by considering whether it satisfies this characterisation of human episodic memory – it almost certainly will not.

Episodic memory plays functional roles in the cognitive lives of humans that it would almost certainly not play in the lives of animals, if they had it. For instance, Johannes Mahr and Gergely Csibra (Mahr & Csibra, 2018) argue that episodic memory supports sociocommunicative practices like making and enforcing commitments and evaluating testimony. Since animals don't speak, they can't possibly have a form of memory that plays these roles for them. Similarly, if episodic memory exists in nonhuman species it is likely to differ from human episodic memory at the level of neurobiological mechanism, for two reasons. First, any differences in the functional profiles of human and nonhuman episodic memory would likely be mirrored at the level of neurobiological mechanism. Second, the brains of different species differ from one another, the more so, the more distantly related they are. For instance, the hippocampus is known to be a crucial structure for episodic memory in humans. But some of the species in which comparative psychologists investigate episodic memory, including cuttlefish and bees, lack a hippocampus altogether. So, if these non-hippocampal species did have episodic memory, the mechanisms underpinning their episodic memory could not be just the same as those underpinning the capacity in humans.

[4] One way in which this is a simplification is that the relevant properties and mechanisms might be present to a greater or lesser degree in a candidate entity – and so in some cases this approach will deliver no clear verdict on whether this entity 'counts' as an instance of the kind (Taylor, 2020). Another is that in sexually dimorphic species, including many ducks, male and female members of the species may differ significantly, resulting in distinct clusters of species-typical features (see Magnus, 2012, pp. 149–165 for discussion).

Despite these differences, we take it to be a sensible question, whose answer is not obvious in advance, whether animals have episodic memory. So, in asking this question, we cannot be asking whether animals have a form of memory *just like* human episodic memory. Rather, when we ask whether animals have episodic memory, we must be envisaging our capacity for episodic memory as a member of a more inclusive cognitive kind, within which there is room for inter-specific variation.

But how should we characterise this more inclusive kind, and how should we evaluate whether animals' memory capacities belong to it? Here, there's room for disagreement – since we can envisage our capacity for episodic memory as falling into a range of more or less inclusive kinds, depending both on which features of its human manifestation we prioritise, and on how concretely or abstractly we specify them. The disagreement between optimists and kind sceptics can be seen as a difference of opinion with respect to this question. In considering whether animals have episodic memory, optimists tend to adopt sparser characterisations of episodic memory, prioritising fewer of (human) episodic memory's features, and characterising them more abstractly. To see this, we can consider the functional features and the mechanistic underpinnings of episodic memory in turn.

With respect to episodic memory's functional features, Keven (in this volume) argues that animals lack episodic memory because episodic memories bind event elements together into a single representation with temporal, causal and teleological structure, and there are reasons for thinking that these structural properties are absent from nonhuman memories. At the same time, optimists conclude that animals have episodic memory on the basis of evidence adduced using the criteria for episodic memory listed in §2. The picture of episodic memory suggested by these criteria is one on which episodic memories bind event elements together into a single, structured representation of the event. But whilst this involves having a representation with spatial, and perhaps temporal, structure, there is notably no requirement that episodic memories have causal or teleological structure. In short, the criteria appealed to by optimists suggest a sparser conception of its functional features, on which episodic memories must be structured, but need not have all of the structural features by which Keven takes them to be characterised in humans. This, I take it, rather than a dispute over whether animals' memories have these structural features, explains their greater willingness to ascribe episodic memory to nonhuman animals.[5]

Similarly, Malanowski argues that it would be premature to declare that animals have episodic memory, because the mechanisms underpinning nonhuman memory could differ from those underpinning human episodic memory. The point that further research into the mechanisms of nonhuman memory is needed is well-taken. But it is a further question what sort of evidence would be required to establish that the mechanisms underpinning human and nonhuman memory were the same – or, to put it another way, what 'sameness of mechanism' consists in. This question is complicated because, as Carl Craver (2009) argues, there is never just one way to specify the mechanisms underpinning our cognitive capacities. The same mechanism might be characterised at a coarser or finer level of grain, or in more abstract or concrete terms. How the mechanism is characterised will affect our judgments about whether

[5] Those optimists who take temporal structure to be characteristic of episodic memory will also dispute Keven's claim that animals' memories lack this structure, perhaps appealing to evidence that rats' memories of events carry sequence information (Panoz-Brown et al., 2018). Too little evidence bears directly on this question to settle it with any certainty. In any case, I suggest, the remainder of the disagreement in this case concerns the characterisation of episodic memory. Moreover, some optimists take temporal information to be less central in characterising episodic memory (Eacott & Easton, 2010). Here, I suggest their dispute with kind sceptics is explained without remainder in terms of their differing characterisations of episodic memory.

a given mechanism counts as 'the same'. If we were to describe the mechanisms underpinning my own episodic memory capacity in sufficiently minute, concrete detail, then even the mechanisms underpinning *your* episodic memory would not count as examples of the same mechanism. On the other hand, if we described those same mechanisms very coarsely and abstractly, it is conceivable that mechanisms of the same kind might be found even in creatures with radically different brains.

Just as optimists assume a sparser characterisation of episodic memory's functional profile of episodic memory than sceptics do, I suggest that they also think of the mechanisms underpinning episodic memory in relatively sparse, abstract terms. For instance, Allen and Fortin write,

> 'The circuit [underpinning episodic memory in mammals] requires higher association areas to process the sensory information (neocortex), interface areas to communicate with the hippocampus (parahippocampal region), the hippocampus to integrate and retrieve information about the episode, and executive areas to produce the appropriate behaviour (prefrontal cortex) […] [Birds] have a similar circuit that could perform the same fundamental operations. The corresponding system in birds involves a combination of homologous […] and analogous […] structures. Therefore, we hypothesise that a fundamental circuit may be shared between species that demonstrate episodic memory abilities.'
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> (2013, p. 10383)

Allen and Fortin hypothesise that the mechanisms underpinning episodic memory are shared between birds and mammals because birds have a circuit that could perform the operations they take to be fundamental to the mechanisms of episodic memory in mammals – things like processing, integrating and retrieving information, and putting it to use in directing behaviour. They offer this hypothesis despite being entirely aware that, when characterized exhaustively, in fine-grained and concrete detail, there will be many differences between the mechanisms operating in birds and mammals. This suggests that they operate with a relatively sparse and abstract picture of the mechanisms of episodic memory and take these differences between birds and mammals to be consistent with the hypothesis that the mechanisms are the same.

On the other hand, Malanowski is inclined to individuate the mechanisms of memory in less inclusive terms. She writes that, 'the description of the mechanism needs to be fine-grained enough to allow us to determine if a particular species would make a good model for studying human memory disorders' – suggesting a view on which sameness requires similarity at this more fine-grained level. On the subject of Allen and Fortin's claim above, she suggests that the mechanisms of memory in mammals and birds 'are likely to be only similar on some broad scale of comparison [… and] work, neurobiologically, in different ways'. As such, she denies that these mechanisms are likely to be the same.

Summarising, I've suggested in this section that that the difference of opinion between optimists and kind sceptics does not primarily concern whether animals' and humans' memory capacities differ in the ways kind sceptics suggest. Rather, the dispute is about how this bears on whether animals have episodic memory – which in turn bottoms out in a dispute about how inclusively episodic memory should be characterised and delineated. Optimists, who characterise episodic memory in fairly sparse and abstract terms, are inclined to delineate it relatively inclusively, and so to hold that the differences to which kind sceptics advert are consistent with the claim that animals have episodic memory. Kind sceptics, who characterise episodic memory in richer and more concrete terms, disagree.

## 5. Moving Forward

How might we make progress with this disagreement? A natural response, in light of what I've said so far, would be that we can't, because this is a trivial terminological dispute. When kind sceptics claim that animals lack episodic memory, they mean one thing. When optimists argue that animals have episodic memory, they're mean something else. There's little to be gained by policing terminology, and no sense asking what the term 'episodic memory' *really* denotes.

In a sense, this is right: this is a dispute about terminology. But not all terminological disputes are trivial. A dispute about the 'ultimate' or 'objective' meaning and extension of 'episodic memory' would be a waste of energy. But this dispute is about what 'episodic memory' picks out, or should pick out, *in a certain scientific context* – it's about how to delineate the object of the episodic memory research programme in comparative psychology. And this is not a trivial matter.

Suppose I develop a remedy that eliminates symptoms of a certain virus, and I take this to a virologist attempting to develop a cure. I tell her that she can halt her work, because I've cured the virus. She may rightly reply that I've done no such thing: I've merely developed a treatment. It will be no good for me to reply that, since I'm using 'cures' to mean 'eliminates the symptoms' our dispute is terminological, and that since there's no fact of the matter about what 'cure' *really* means, my use of the term can't be criticised. Quite clearly, it can. I intended to intervene in her project, but by using the term 'cure' in the way I do, I have only succeeded in changing the subject. Intervening in a scientific project is not a terminological free-for-all. It requires sensitivity to what scientists engaged in that project take themselves to be talking about, and to what they are trying to achieve.

This is not to say that we must defer entirely to scientists' uses of terminology, or to their characterisations of their objects of study – since it may be that another way of conceptualising phenomena would be more productive, from the point of view of their theoretical goals. For instance, it might be that in certain circumstances, the distinction between curing a virus and treating its symptoms is less important than in others: perhaps there are viruses for which eliminating the symptoms is as good as a cure. But for other viruses, including those that spread asymptomatically, it is not. If my virologist's project concerned the first kind of virus, there might be something to be said for my intervention after all: perhaps her goals would be well served by the adoption of a more inclusive characterisation of 'cure'.

All this is to say that whilst there might not be a single, ultimately correct way of characterising episodic memory, not all ways of characterising and delineating it will be equally suitable in all contexts. Different theoretical interests may call for different delineations of a phenomenon (Taylor, 2019). So, having said that kind sceptics and optimists characterise episodic memory in different ways, we should not declare their dispute terminological and wash our hands of it. Instead, we should consider what those engaged in the episodic memory research programme in comparative psychology are up to and ask how episodic memory ought to be delineated relative to their theoretical interests.

At this point, Malanowski might point out that in making her kind sceptical argument, she did exactly this. She is explicit about the role theoretical interests play in determining how phenomena should be characterised and delineated. She suggests that the central goal of the episodic memory research programme in comparative psychology is to achieve a better understanding of how *human* episodic memory works, with a view to developing treatments

for pathologies of memory (Malanowski, 2016). It's with this in mind that she argues for a characterisation of episodic memory in fine-grained and concrete terms.

There's no denying that some comparative psychologists approach the question of nonhuman episodic memory with this theoretical interest in view. Babb and Crystal (2006), for instance, state that establishing a rodent model of episodic memory holds 'enormous potential' for understanding and treating memory pathologies. And it seems right that if our interest is in, say, using rats as a model for determining which drugs will be useful in treating Alzheimer's, then we had better delineate the both the functional profile and mechanisms of memory sufficiently concretely to allow us to make reliable inferences about that. In fact, even if it is true that more work remains to be done, I take it that Crystal and his colleagues have studied rats so extensively, assessing them against a much wider range of criteria than have been applied to most species, for just this reason: because their theoretical interests demand similarity between human and rat memory at a fine-grained and concrete level.

But this is not the only, or even the most central, goal driving episodic memory research in comparative psychology. Scientists ask whether animals have episodic memory with a view to satisfying a wider range of curiosities. For instance, some psychologists studying episodic memory in animals hope to draw conclusions about animal welfare. Amy-Lee Kouwenberg and colleagues (Kouwenberg et al., 2009) suggest that their findings about memory in Yucatan minipigs 'indicate the need for increased consideration of memory and learning in modern swine husbandry and housing guidelines', proposing that if pigs have episodic memory, they may benefit from environmental enrichments including more complex feeding systems.

When we ask whether animals have episodic memory with considerations of welfare in mind, it is not obviously productive to characterise episodic memory in just the same way that we would in the context of biomedical science. Here, our interest is in whether animals have a memory capacity that is of a kind with ours in a different sense – viz, one which carries at least some of the same ethical weight. Exactly how episodic memory should be characterised and delineated for this purpose is unclear and will turn on what we take the ethical weight of episodic memory to be, and on what gives it that ethical weight. Relative to this project, we may both prioritise different features of episodic memory and characterise them at a different level of abstraction than we would in a biomedical context. It's plausible that the fine-grained mechanistic underpinnings of episodic memory may be less important with respect to this project than with respect to the biomedical one – and we might be more inclined to prioritise interactions between episodic memory and other cognitive capacities, such as traumatic memory, boredom and regret.

Perhaps most centrally, comparative psychologists ask whether animals have episodic memory with a view to furthering our understanding of its origins. Determining which animals have episodic memory is relevant to understanding when, why, in what circumstances and how many times episodic memory emerged, as well as its relationship to other cognitive capacities. A comparative study of episodic memory may also reveal ways in which, if it is not uniquely human, it varies from species to species. Many comparative psychologists take these kinds of evolutionary questions to be at the heart of the comparative psychological project (Eaton et al., 2018). The central question of Allen and Fortin's paper, above, is whether episodic memory evolved convergently in mammals and birds, as Emery and Clayton (2004) suggest, or before the mammalian/reptilian divergence. Similarly, Christelle Jozet-Alves and colleagues (Jozet-Alves et al., 2013) conclude their report about episodic memory in cuttlefish by suggesting that it represents 'a genuine case of evolutionary convergence', which may shed new light on the evolution of cognition.

If our interest is in tracking the development of episodic memory over evolutionary time, we had better not cleave too closely to its human manifestation in characterising it. Rather, we should characterise it sparsely and abstractly enough to enable us to detect evolutionarily older and simpler forms, and any species-specific forms that may have emerged. Similarly, whilst it is true that *bona fide* cases of evolutionary convergence require sameness of kind – similar functional properties underpinned by similar mechanisms – this need only be at a certain level of abstraction. The camera eyes of vertebrates and invertebrates, the paradigm case of evolutionary convergence, exhibit important differences at a fine-grained and concrete level in virtue of which one could certainly view them as different in kind. But claims of evolutionary convergence are made at a slightly more abstract level of description, and so tolerate this sort of variation. So again, claims about the evolutionary convergence of episodic memory must be made and evaluated with a relatively abstract and inclusive conception of episodic memory in view.

If this is right, and if nonhuman episodic memory researchers are often motivated by these evolutionary questions, the kind sceptic's objection will often amount to changing the subject. It may be true that humans' and animals' memories differ in the ways kind sceptics propose. But this doesn't obviously bear on the claim that animals have episodic memory, when it's made in the context of this evolutionary project. And nor should it: a sparse and inclusive characterisation of episodic memory, such as the one favoured by optimists, is appropriate relative to this project. At the same time, it's important to bear in mind that this inclusive characterisation of episodic memory won't be appropriate with respect to *every* project – and so evidence that supports the claim that animals have episodic memory in this inclusive sense may not establish anything about, say, animals' ethical status or their potential as models of human memory. Since our goals in asking whether animals have episodic memory play an important role in determining how 'episodic memory' ought to be delineated, our judgments about whether animals have episodic memory may vary from project to project. In short, the argument I've been making points toward a form of pluralism.

One might have concerns about this pluralist position. Isn't it confusing to suggest that episodic memory can be characterised and delineated in different ways for different purposes? Perhaps this will lead to communication problems: hearing from evolutionarily-motivated researchers that cuttlefish have episodic memory, biomedical researchers might be led to conduct dead-end research on cuttlefish as models of human memory.[6] It's worth emphasising that this isn't a challenge to the substantive claim I have been making in this chapter: that comparative psychologists investigating episodic memory do so with different goals in view, and so (appropriately) characterise and delineate their object of study in different ways. Rather, it is a question about what we should do, having made that observation. Should we be pluralists, and treat them as characterising the same phenomenon in different ways, or should we be 'splitters', introducing new terminology to differentiate their objects of study?

Choices between pluralism and splitting are finely balanced, with risks to consider on both sides. As noted above, pluralism can generate confusion and this can provide a legitimate reason to reject it (Taylor & Vickers, 2017). On the other hand, splitting might lead us to disregard important connections between different research areas. For instance, it might turn out that the similarities between human and cuttlefish memory are such that it would be productive to explore cuttlefish as models of human memory - but we might miss this if we introduce terminological distinctions to separate the evolutionary and the biomedical project. How to balance these risks is a tricky question, and at least partly an empirical one. But one

[6] Thanks to Nazim Keven for pressing this worry.

thing I have already mentioned tells in favour of pluralism – namely, that although researchers aiming to develop rodent models of memory pathologies draw on related research with evolutionary motivations, they operate with different evidential standards, seeking positive results against a more diverse range of criteria. So, matching the delineation of episodic memory to the demands of the task at hand is something comparative psychologists, to some extent, already do.

## 6. Conclusion

Answering whether animals have episodic memory requires a determination on how episodic memory should be characterised and delineated. The dispute between kind sceptics and optimists is rooted in a disagreement about this question. I proposed that we can make progress by considering what scientists are trying to achieve by asking whether animals have episodic memory. Different characterisations of episodic memory may be more appropriate than others, relative to particular theoretical goals. I argued that comparative psychologists ask whether animals have episodic memory in the service of a number of projects. But with respect to at least some of these projects – including attempts to understand the evolution of cognition – the narrow delineations of episodic memory insisted upon by kind sceptics are inappropriate, and kind scepticism misfires. So with respect to those projects at least, there are grounds for optimism.

More importantly, I've suggested that the various projects that motivate scientists to ask whether animals have episodic memory are incommensurate, in the sense that they require different characterisations of episodic memory. So, although I've suggested that optimism may be justified in certain contexts, I have not defended a straightforward 'yes or no' answer to whether animals have episodic memory. Rather, I've suggested that there isn't one: we can sensibly ask this question only with a particular project in view. In virtue of being incommensurate, different projects may yield different answers. This may not be entirely satisfying, but dissatisfaction is an occupational hazard. As Mary Midgley (2018, p. 50) writes,

> philosophy, in fact, is all about *how* to think in difficult cases […] It is a set of practical arts far more like the skills involved in exploring an unknown forest than they are like the search for a single buried treasure called the Truth. And because of this, it is far more concerned with the kind of questions that we should ask than with how, at any particular time, we should answer them.

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