On Being Stuck in Time

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Abstract:

It is sometimes claimed that non-human animals (and perhaps also young children) live their lives entirely in the present and are cognitively 'stuck in time'. Adult humans, by contrast, are said to be able to engage in 'mental time travel'. One possible way of making sense of this distinction is in terms of the idea that animals and young children cannot engage in tensed thought, which might seem a preposterous idea in the light of certain findings in comparative and developmental psychology. I try to make this idea less preposterous by looking into some of the cognitive requirements for tensed thought. In particular, I suggest that tensed thought requires a specific form of causal understanding, which animals and young children may not possess.

Keywords: Mental time travel, tensed thought, causal understanding

1. Introduction

Is the mental life of (at least some) non-human animals fundamentally quite similar to our own, or is the relationship between human beings and the rest of the animal kingdom marked by some deep discontinuity? Amongst those who have held the latter view, two, on the face of it quite different, approaches stand out. Many writers have taken language to be the key feature that sets humans off from the rest of the animal kingdom, and have appealed to animals' lack of language to both explain and make good the claim that their minds are radically unlike our own.[1] However, there is also a tradition of writers who have seized upon a different aspect of mental life to articulate what the key difference comes to. Take, for instance, the following passage from Friedrich Nietzsche's 'Untimely Meditations':

> Consider the cattle, grazing as they pass you by: they do not know what is meant by yesterday or today, they leap about, eat, rest, digest, leap about again, and so from morn till night and from day to day, fettered to the moment and its pleasure or displeasure, and thus neither melancholy nor bored. This is a hard sight for man to see; for, though he thinks himself better than the animals because he is human, he cannot help envying them their happiness. (Nietzsche 1983, pp. 60f.).

We can set aside Nietzsche's particular views on who comes out better here. The key claim, as it is sometimes put, is that animals live their lives entirely in the present, or that they are cognitively stuck in time.[2] Perhaps the same is true of young children,

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[1] Davidson (1982) is an obvious contemporary example.

[2] For some other versions of this claim, or at least similar claims, made at various points in the history of philosophy see, e.g., Aristotle (1930, 453a4-13), Schopenhauer (1999, p. 30), Bergson (1988, pp. 93f.), Dennett (2005, pp. 168f.). In psychology, influential sources for the claim that animals' cognitive life is restricted to the present include Koehler (1927, p. 272) and (as one referee has pointed out to me) Donald (1991, p. 149). Of course, it is not necessary to see this claim as being in competition with the claim that the deep discontinuity between humans and other animals turns on the fact that the latter

we might add. Adult humans, by contrast, are said to be capable of cognitively transcending the boundaries of the present; they can engage in mental time travel.

Beyond such metaphorical descriptions, however, it actually turns out to be surprisingly hard to get a grip on what exactly the distinction at issue is meant to come to. Consider, for instance, a recent debate that was triggered by a study on scrub jays carried out by Nicky Clayton and Tony Dickinson (1998). The study ingeniously exploited the fact that scrub jays eat both worms and peanuts, but much prefer worms. At the beginning of the study, the birds were given a number of training trials during which they had the opportunity to cache worms in sand trays; but they also learned that, while those worms were still edible 4 hours after caching, they were no longer edible 124 hours after caching. Furthermore, they learnt that cached peanuts were still edible after either of those delays. During the test phase, birds were given an opportunity to cache, first, one of these two types of foodstuff in one side of a tray, and then, following a 120 hour delay, the other type of foodstuff in the other side of the tray. Four hours after the second caching, they were allowed to search the tray for foodstuffs.[3] The crucial finding was that the location of the birds' searches depended on the delay between the initial caching of the worms and the subsequent search. If the worms had been cached in the first caching session, 124 hours before test, then the jays preferred to search for peanuts. If the worms had been cached just 4 hours before test, the jays preferred to search for worms.

Endel Tulving calls this an "ingenious and convincing demonstration" of quite sophisticated memory abilities in the birds studied by Clayton and her colleagues, but then he goes on to say:

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lack language. Bennett (1964), whom I will discuss below, is one example of a philosopher who thinks that the two claims are connected.

[3] The experimenters actually removed the cached items before testing to ensure that the birds were not able to base their searches on olfactory cues. There was also a control involving scrub jays that were not given the training trial, but then went through the same test phase.

> The only thing missing is evidence that they have human-like conscious recollections of their worm and nut caching activities. They may just 'know' what kind of food is where, and what state it is in – fresh or rotten – without knowing how or why they know it. (Tulving 2001, p. 1512).

I take it that this is Tulving's way of putting the point that, despite Clayton & Dickinson's findings, scrub jays might nevertheless be incapable of mental time travel, and that their cognitive abilities thus fall short of our own in quite a fundamental respect. Similar views have been expressed in a series of papers by Thomas Suddendorf (e.g., Suddendorf & Busby, 2003; Suddendorf & Corballis, 1997, 2007). At the same time, there have also been rejoinders from Clayton and her colleagues (Clayton et al., 2003), and from other comparative psychologists who have claimed to have demonstrated mental time travel in animals, questioning the empirical tractability of the claims made by Tulving and Suddendorf (see, e.g., Eichenbaum et al., 2005).

I think it is worth bringing out, though, that, even in the short passage I have quoted from Tulving (2001), there actually seem to be at least three quite different ideas at work as to what the crucial difference between humans and other animals that is at issue might come to.

(1) One distinction Tulving alludes to, which has emerged from the literature on adult memory, is that between remembering (or, as he puts it here, "conscious recollection"), on the one hand, and knowing, on the other. The basic thought here goes back to the idea of a distinction between two different kinds of memory, for which Tulving (1972) originally coined the terms 'episodic memory' and 'semantic memory'. As it is usually understood, the remembering/knowing distinction is meant to indicate that episodic recall of particular past events, i.e. the type of remembering

that constitutes mental time travel into the past, involves a specific kind of conscious experience, typically called recollective experience. By contrast, such recollective experience is absent when retrieval is merely a matter of calling up previously acquired knowledge from semantic memory. It is thought that this difference can be tapped into empirically in studies in which participants are asked questions about a number of previously presented items and are instructed, in each case, to classify their responses as ones that are based on 'remembering' the item, on the one hand, or just 'knowing' that the item was there, on the other. Adult participants in such studies can readily make sense of this instruction, and their responses can be selectively influenced by a number of task variables at encoding or retrieval.

(2) Another, potentially quite separate, issue that Tulving alludes to is whether the scrub jays studied by Clayton and her colleagues just know, say, 124 hours after caching, that there is no point going back to the side of the tray where the worms have been cached, or whether, in addition, they can also be said to know how or why they know this. Thus, the implied idea here would be that mental time travel involves some form of metacognition or self-conscious reflection, i.e. a capacity to reflect on one's past experiences as the source of one's present knowledge, or more generally to appreciate relationships between one's own mental states at different times. This idea is particularly prominent in Suddendorf's way of framing the question as to whether or not animals are capable of mental time travel (cf. Suddendorf & Busby, 2003; Suddendorf & Corballis, 1997, 2007; see also Perner, 2007).

Perhaps unsurprisingly, though, some animal researchers and developmentalists have found neither of the above two ways of drawing a distinction between those capable and those incapable of mental time travel very helpful (see, e.g., Clayton et al., 2003; McCormack & Hoerl, 2001). It is difficult to see, for

instance, how to construct a non-verbal measure that might be deemed equivalent to the type of task used to explore the remembering/knowing distinction in adults. Similarly, we might grant that the ability to recollect the past seems to play a crucial role in allowing us to grasp the sources of some of our knowledge – how or why we know what we do[4] – but it is at least not obvious why the ability to recollect the past should itself, in turn, depend on such metacognitive abilities.

At any rate, it is easy to get a sense that the basic issue that Nietzsche had in mind when he wrote that animals are "fettered to the present" gets somewhat lost here. Of course, one response to this might be that this is not very surprising – perhaps the kind of intuition articulated by Nietzsche is just too crude and can easily be shown to be false by studies such as Clayton & Dickinson's. I want to suggest, though, that that would be the wrong response.

(3) In addition to the two distinctions I have already mentioned, there is a third one that is at least hinted at in the above quotation from Tulving, which I would like to look at in more detail. Even though there are other passages in which Tulving seems to agree with Clayton & Dickinson (1998) that their studies show memory for 'what, where and when' in scrub jays, the wording in this passage actually suggests a slightly different reading. Note that part of what Tulving seems to be concerned with is the question of whether we should explain the birds' behaviour in terms of notions such as 'what kind of food <u>is</u> where, and what state it <u>is</u> in – fresh or rotten'. At least on the face of it, this contrasts with an explanation in terms of <u>tensed</u> notions, such as '<u>was</u> cached <u>a short while ago</u>' or '<u>was</u> cached <u>a long time ago</u>'.[5] This is the contrast I want to concentrate on in what follows.

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[4] See, e.g. Zentall (2005), see also Hoerl (2001), for a similar point

[5] Of course, the former type of notion may also be seen as employing tense, i.e. the present tense. I will shortly try to make a case for saying that the crucial distinction at issue here is indeed one between

In short, I believe that there is a very basic difference between two ways of being sensitive to the passing of time, which provides perhaps the most straightforward way of giving substance to the idea that animals are incapable of mental time travel. I will refer to this difference as that between engaging in tensed thought, on the one hand, vs. merely updating one's model of the world as time goes by, on the other. It is relatively easy to state what the difference consists in; what will take more work is making plausible the idea that it is indeed a difference as basic at this that is at issue in the claim that animals are stuck in time, i.e., that the claim doesn't come out obviously false once it is framed in terms of this difference.

In the next section, I will give a general outline of the basic distinction I have in mind, and show how it might be put to use in interpreting Clayton & Dickinson's findings. In section three, I will show how the same distinction can also be applied to show that learning to perform or recount sequences of actions need not involve a grasp of tensed notions, and compare this view with one recently put forward by John Campbell (2006), according to which such sequential learning abilities do involve a grasp of tensed notions, albeit ones that are more primitive, in a crucial respect, than those at work in mature human thought about time. Finally, in section four, I will make a suggestion as to what sorts of learning abilities do, on my view, provide evidence for a grasp of tensed notions.

2. Mere updating vs. temporal thought: the basic distinction

Even though variants of the claim that animals are stuck in time have made repeated appearances throughout the history of philosophy, it is not easy to find detailed arguments for it. In what follows, I will draw on an argument offered by Jonathan

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notions that employ tense and notions that do not employ tense at all, even though we might have to use present tense morphology to capture the latter in English.

Bennett (1964), which runs as follows. Suppose that we observe an animal behaving in a particular way some time after it has been in a certain kind of situation, or has done a certain thing. Bennett's example is that of a dog retrieving a bone from a location where it had buried the bone a while ago. On the basis of this observation, we might be tempted to attribute to the dog a belief about the past, such as 'A bone was buried there'. Yet, as Bennett points out, if it is to yield an explanation of the dog's behaviour, the attribution of such a belief about the past must be accompanied by the attribution of a further, general, belief, such as the belief 'Buried bones tend to stay put'. The first thing that might strike us as being problematic here is the attribution of that second, general, belief. However, according to Bennett, the real difficulty lies elsewhere. If the dog's behaviour can only manifest possession of the two beliefs in combination, it is unclear what saying that there are nevertheless two distinct mental states, one dealing with the past and one dealing with the general, might come to. It seems that we can only speak of two separate beliefs if we can distinguish them by the role they have within the dog's cognitive life, and it is difficult to see how we could do so, if they issue in behaviour only when combined.

Bennett (1976, p. 103) summarizes the general point of the above argument by saying that, in the case of non-linguistic animals, "the attribution of a past belief [i.e. a belief <u>about</u> a past occurrence] can be effectively challenged by a lower-level, more economical, attribution in which the past is only introduced causally". The general way in which such a challenge might proceed is further fleshed out by Peter Smith (1982, p. 434), who says: "Where [one putative explanation] would explain present behaviour by reference to a past belief combined with a general belief, the

undercutting explanation would posit a past acquisition of a [...] present-tensed belief [...] and refer to the general propensity of states to persist over time."[6]

I want to suggest that something like the line of thought that Bennett and Smith describe here is the real source of the intuition that animals are stuck in time. However, I also think that Smith slightly mis-characterizes the key issue at stake. Where Smith says that the undercutting explanation ascribes to the dog a present-tense belief acquired in the past, rather than a past-tense belief together with a general belief, I think we should say that, on the undercutting explanation, there is a sense in which the dog's belief lacks tense altogether. Arguably, saying that the dog employs a present-tense belief still suggests that the dog operates with a distinction between how things are now and how they are at other times.[7] What Bennett and Smith's undercutting strategy seems to give us, instead, is a way of making sense of the dog's behaviour without appealing to any notion of other times at all.

The key general move in the undercutting strategy as described by Smith, I believe, is to show how an explanation of a given set of behaviours over time might be available on the level of facts about beliefs, and about the conditions that determine their persistence, rather than on the level of how (if at all) time itself is represented in those beliefs.[8] Once the issue at stake has been put in those terms,

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[6] I am simplifying the dialectical situation here. Bennett (1976), from which the first quotation in this paragraph is taken, actually goes on to criticise the argument from Bennett (1964) that I have sketched. He suggests that non-linguistic behaviour might, after all, warrant the ascription of separate past and general beliefs, if there is a range of different behaviours the animal engages in that can be explained by attributing a past belief that combines with a number of different general beliefs or vice versa. Smith's (1982) paper, from which the second quotation is taken, considers this suggestion and argues that it underestimates the strength of Bennett's (1964) argument, i.e. the undercutting strategy can be made to work even in cases where there is a range of behaviours as envisaged by Bennett (1976). For the purposes of this paper, I will assume that Smith's defense of Bennett's (1964) argument is sound.

[7] See also the discussion of Campbell's (2006) views below.

[8] On some accounts of propositional attitudes, we should actually hold back from crediting the dog with beliefs at all if the argument offered here is correct. Elsewhere in this paper, I also speak of animals' (and childrens') 'model of the world', which is perhaps a more neutral expression.

however, it should also be clear that the example used by Bennett and Smith is in fact only one example on a much wider spectrum.

Consider again, for instance, Clayton & Dickinson's (1998) scrub jays and the claim that they demonstrate episodic or episodic-like memory of past events. Teresa McCormack (2001) has offered a critique of this claim, which picks up on statements like the following from Griffiths, Dickinson and Clayton:

> In terms of […] criteria for episodic memory, the animal must be able to encode the information based on a single, personal experience that occurred in the past, and then accurately recall the information about what happened, where and when, at a later date. (Griffiths, Dickinson and Clayton 1999, pp. 76f.)

Griffiths et al. are here trying to offer a set of criteria for episodic memory that sets aside some of Tulving's claims about the involvement of a particular kind of conscious experience and metacognitive abilities in episodic memory – claims that are difficult to bring to bear in studies on animals. As McCormack argues, though, it is far from obvious that the caching studies actually demonstrate that scrub jays have anything like episodic memory even by Griffith et al.'s criteria. She points out that it is plausible to think that the jays' behaviour is governed by some sort of interval timer that is entrained during the learning trials in which the birds find out that the worms decay within 124 hours. The idea of such a timer, an internal mechanism that is sensitive to the time that has elapsed since a certain stimulus, has been used to explain performance of both animals and humans on a variety of timing tasks, and there are a number of different theoretical models of how such timers might operate (see Wearden, 2001, for a review). For present purposes, the basic idea is that, in Griffith's et al.'s experiment, cashing of worms triggers such a timer, the state of which changes

in a systematic way as time elapses, and during the learning trials only certain states of the timer become associated with the availability of edible worms. In the test trials, in the absence of any other cues, it is then the state of the timer at a given time since the cashing of worms that determines whether the birds search for food or not. Yet, if this is the correct description of the mechanisms underlying the birds' behaviour, it seems potentially quite misleading to say, as Griffiths et al. do, that the birds recall information about when the worms were cached. As McCormack puts it,

> Of course, in principle, […] such a timer might be used to work out the temporal context of the previous caching event (analogous to using information about the time elapsed on a stop-watch to work out when it was switched on). However, there would be no need to assume that the birds actually derive that previous context. (McCormack, 2001, p. 289).

There is scope for further discussion of the details of McCormack's challenge and how exactly it needs to be spelled out to apply to Griffiths et al.'s findings (see de Kort et al., 2005, pp. 169f.). The basic point I want to bring out is that this challenge can actually be seen as a version of Bennett and Smith's undercutting strategy. The critical point is that the function of the interval timer might simply be to determine how long the jays retain the belief that there are worms in a certain location, so that, after a certain period of time has elapsed, it simply no longer occurs to them to search the side of the tray where the worms were cached.[9]

In the background of both Bennett and Smith's as well as McCormack's arguments, there seems to be a more general picture of animal cognition, which might

[9] This is not to say that this is the only cognitive role timing mechanisms can play. Peacocke (1999), for instance, develops an account according to which a sensitivity to temporal relations, mediated by such mechanisms, does in fact also have a crucial role to play in understanding the past tense. However, he also notes that "[t]o possess a sub-personal mechanism which is, when functioning properly, […] temporally sensitive is of course not yet to have mastered temporal thought" (Peacocke, 1999, p. 90), which is in effect the same issue that is at stake in the above quotation from McCormack (2001).

be summarized as follows. At any one time, the animal simply entertains a model of how the world is or might be. Whilst the ingredients of that model have been acquired in the past, they are of significance to the animal only in as far as they can inform its actions or expectations. Over time, elements of the model can change either because they get superseded by new information, or because their persistence is governed by a timing mechanism.[10] Either way, the result is simply that of the model being updated. Previous information that is no longer relevant to action or expectation is simply discarded, rather than being retained, say, in the form of past-tensed beliefs.

The key idea here is thus that of a fundamental distinction between two different ways in which cognition can be sensitive to the passing of time, which we might call mere updating vs. tensed thought. At the end of the previous section, I suggested that the idea that animals, and possibly also young children, are unable to engage in tensed thought might provide one way of giving content to the claim that they are stuck in time. My aim in this section was to show just how, at least in the case of animals, ascriptions of tensed thoughts might be challenged using a particular sort of undercutting strategy. What is revealed by this strategy is precisely how certain forms of behaviour might equally well be explained by the idea of the animal operating with a model of its environment that is maintained and updated in various ways as time goes by, but in which each update simply replaces its predecessor without making room for the idea of other times, as times at which things were (or will be) different from how that update has it.

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[10] There are also cases in which it might be more appropriate to say that the function of the timing mechanism is to suppress certain elements of the model for periods of time. This type of description might be applied, for instance, to capture the role interval timers have in preventing hummingbirds from revisiting a food source for a certain period of time, thus allowing the food source to replenish (cf. Henderson et al., 2006). I should also add, here, that we need to allow that the model an animal operates with might be fairly disunified, or, as we might also put it, that an animal might be seen to operate with several different models, which are updated in different ways and on different timescales, relative to different sets of practical purposes. I am grateful to an anonymous reviewer for alerting me to this latter point.

3. Sequential Learning, Imagination and Tense

A natural first response to what I have said so far is that I must have misunderstood the issues at stake in the existing debate over mental time travel in animals and humans that writers such as Tulving (2001) and Suddendorf and Corballis (2007) are engaged in; I have simply changed the topic. In particular, the existing debate is concerned with mental time travel as a particular form of exercise of the imagination, or at least something akin to it, and it is at least not obvious that having beliefs about the past requires such an imaginative ability. It is frequently pointed out by authors such as Tulving that much human thinking about the past and the future does not involve mental time travel at all, for instance when we recall the date of the battle of Hastings.

Furthermore, the response might continue, it is simply preposterous to suggest that animals can't form beliefs about the past, and even more so for the case of young children. There is a wide variety of research that might be seen to provide evidence against this suggestion by showing that animals are capable of learning to perform not just individual actions, but ordered sequences of actions. Similarly, it has been shown that even quite young children are capable of retaining knowledge about familiar sequences of events – such as going to a fast-food restaurant, or visiting the doctor – in the form of scripts. On the face of it, learning about the correct order of events in a sequence requires an ability to keep track of the elements of the sequence that have already been performed and the ones that are still to come. There needs to be some sensitivity to temporal facts in place if an animal is to carry off the sequence or a child is to recount a script in the right order. Thus, it may again seem that the issues I have been talking about can't be the same issues that are at stake in the existing literature

on mental time travel, where it is usually assumed that it is a live option that animals and young children are incapable of mental time travel, even though they can learn about sequences.

We can put both of these points into focus by looking at a view recently put forward by John Campbell (2006), which contrasts with the view I have sketched. On Campbell's picture, animals and young children do have a rudimentary notion of the past and the future, but the key difference between them and us consists in the fact that their temporal horizon is, so to speak, much smaller than ours. Thus, for instance, a child recounting a fast-food restaurant or a going-to-the-doctor script might be able to grasp temporal relationships between the different elements within each script, but might be at a loss when it comes to understanding the question as to which of two things she did more recently: go to the doctor or eat at a fast-food restaurant. The way in which Campbell expresses this idea is as follows. He says we should credit the child with tensed notions – for instance a notion of 'now', which is governed by the general token-reflexive rule for 'now' that any token of it refers to the time at which it is produced. Yet, he also holds that there is a difference in meaning between the child's 'now' and 'now' as understood by an adult, because the underlying domain of times is different (and similarly for other tensed notions the child employs).

> The domain of times over which this [token-reflexive] rule is defined will not, of course, be times drawn from our ordinary range of linearly organised times; they will themselves be times defined in terms of the temporal framework provided by the script. Within each script times are temporally related; but we cannot express temporal relations between times identified in different scripts. (Campbell, 2006, p. 6)

Is there an alternative to the kind of view that Campbell puts forward? Here, too, it seems that one alternative to postulating a grasp of tenses, even one that is fairly primitive when compared with a mature grasp of tenses, is to make use of a distinction between tensed thought and a more simple type of sensitivity to temporal relations that involves only the updating of a model.

Note, first of all, that it is possible to mount an argument against Campbell's view that mirrors, at least to some extent, Bennett's argument as presented in the previous section. As in Bennett's argument, we start with a specific sort of behaviour over time as our explanandum. What needs to be explained, in this case, is what enables a child correctly to recount or re-enact, say, a sequence of three events, A, B and C. Campbell's view, in effect, offers an explanans that comes in two parts. It implies that we must credit the child both with an ability to think of the order in which A, B and C are arranged, and with the ability to orient herself within this order using tensed notions. The critical sense in which, on Campbell's account, the child's cognitive abilities fall short of those of mature thinkers is that the notions in terms of which the child thinks about the order in which A, B and C are arranged have no application outside the script.

Now, one kind of worry one might raise here concerns the last point: If there is a sense in which a child is indeed capable of thinking of B as coming after A, and of C as coming after B, what exactly prevents the child from applying the same notions also, say, to relations between events within the script and others outside the script? However, I think this worry is actually a symptom of a more fundamental problem. As in Bennett's argument, what we should ask is what justifies us in crediting the child with two separate types of cognitive ability, given that recounting or re-enacting a script necessarily seems to involve combining them. Again, there

seems to be a lower-level undercutting explanation available, according to which it is not an ability to think of the order in which A, B and C are arranged, but rather an ability to think of A, B and C in the right order that underlies script-learning. Thus, as before, the key move in the undercutting strategy consists in pointing out how the behaviour in question can be explained by appealing to processes that govern what happens to elements of the child's model of the world over time, instead of appealing to representations of temporal relations within the model in order to explain the child's behaviour over time. As the child becomes familiar with a certain type of sequence of events, she acquires a routine for updating her model of the world in a particular sequence, thinking of B after thinking of A, and thinking of C after thinking of B. It is at least not obvious that this also requires that the temporal relations between A, B and C be themselves represented within the model.[11]

Yet, this seems to be an obvious point at which to bring in an appeal to imagination. Perhaps there is a primitive way of acquiring scripts for familiar sequences of events that doesn't involve the use of tenses, as I have suggested. But perhaps Campbell is also right that we can credit children and animals with a grasp of tenses, if, in addition to using their knowledge of scripts for recounting or re-enacting familiar sequences, they can also use it to imagine, say, what will be the case in a little while, at a later stage in the sequence that is currently unfolding, or imaginatively undo stages in the sequence that have already happened.

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[11] A similar thought is fleshed out further in McCormack & Hoerl (1999), who relate research on children's acquisition of scripts to a view in linguistics according to which aspectual notions (e.g., completed, ongoing…) are grasped before tensed ones (e.g., past, present…) (see Wagner, 2001, for a recent discussion). McCormack & Hoerl (1999) suggest that children's recounting or re-enacting scripts might indicate an ability to mark events successively as, e.g., ongoing vs. completed, as they go through the script. This ability appears to be more primitive than a grasp of tenses, though, in that it need not involve use of the notion of the time at which an event happens. A child might first think of an event as ongoing, and then as completed, without being able to grasp, say, at the time when she thinks of the event as completed, that there was a time when it was ongoing. In contrast, thinking of an event as past, say, arguably involves assigning it a position in a domain of times, as is also brought out by the quotation from Campbell (2006) above.

I think this suggestion encounters a problem, though, as soon as we try to spell out in more detail exactly how imagination is meant to come in here. To illustrate, consider a person who is having dinner in a busy restaurant. They have just ordered and are waiting for their starter. While doing so, they look at the neighbouring table, at a group that arrived earlier and are already tucking into their dessert. I think we can distinguish between two slightly different types of imaginative project our protagonist might engage in at this point: (i) they might imagine having already finished their starter and main course, and eating their dessert, just like the group at the neighbouring table; or (ii) they might imaginatively advance time and think of the situation that will actually obtain in the future when they will get to their dessert themselves.[12] One way of describing the difference between (i) and (ii) is that, in (i), our protagonist imagines a counterfactual state of affairs as actual, whereas, in (ii), they imagine a state of affairs that is actually yet to come as ongoing.[13] On the face of it, it is only the second type of imaginative exercise that involves mental time travel; the first might simply be described as involving travelling between different possible worlds. The problem is that, in order to distinguish between (i) and (ii) in the first place, it seems that we already have to appeal to a grasp of tenses, on the part of our protagonist, and to the idea that, in the case of (ii), the imaginative project that they are engaged in is itself formulated in terms of the future tense. Thus, I think we can accept that mental time travel consists in or involves a particular form of exercise of

[12] Both types of imagination mentioned here might require the ability to set aside current desires or other mental states in imagination. The development of this ability is explored in experiments carried out, e.g. by Atance & Meltzoff (2006) and by Suddendorf & Busby (2005), which claim to investigate the development of mental time travelling in children. However, precisely because that ability might be required for either form of imaginative exercise mentioned above, it should be clear that there is a further aspect of mental time travel that those experiments don't tap into.

[13] A similar distinction is sometimes drawn in the literature on the development of counterfactual reasoning. It has been argued that some developmental studies might have over-estimated children's command of counterfactuals, because the correct answer to the counterfactual test question could be arrived at by engaging in purely hypothetical reasoning, whereas children of a similar age fail counterfactual tasks that require 'thinking back in time' and considering the particular events that actually happened. See Beck et al. (2006) for discussion.

the imagination, or at least something akin to it. Yet, the ability to engage in the right kind of imaginative exercise that's at issue already presupposes a grasp of tenses; it cannot be what explains such a grasp.

However, I believe that the issue I have just sketched might also give us a hint as to the sort of explanation we need to look for if we want to account for the ability to engage in mental time travel. The key question it raises is how children might give substance to the distinction between events that are not part of the present scene because they're merely possible, not actual, and events that are not part of the present scene because they belong to the future (or the past).[14] I think at least some of the ingredients for an answer to this question can be found in some recent work in comparative and developmental psychology, which I will discuss in the next, final, section of this paper.

4. Tensed Thought and Causal Understanding

In the first section of this paper, I mentioned (and expressed some sympathy with) a common criticism that psychologists have levelled at the way in which the notion of mental time travel has been fleshed by authors such as Tulving (2001) and Suddendorf and Corballis (1997, 2007). The criticism is that crucial elements of their characterization of mental time travel seem to rule out formulating behavioural criteria by which mental time travel could be demonstrated in animals or young children. In contrast to some of what Tulving and Suddendorf and Corballis say, I have suggested that we should think of the crucial question at issue in the claim that animals and young children are stuck in time (i.e., incapable of mental time travel) as

[14] See also Martin, 2001, p. 280, writing about episodic memory: "The infant needs to make sense of how there can be specific, and hence actual, events of which it has [...] conscious awareness, but which are nevertheless not part of the present scene".

that as to whether we can credit them with tensed thought at all. Yet, because we are familiar with tense primarily as a feature of sentences, it may be thought that the account I have offered is ultimately vulnerable to the same criticism as those other writers' accounts, in that it might seem that the only conclusive way in which tensed thought can be manifested is by engaging in tensed talk. I think such a reaction misconstrues the account I have offered, though, and I will try to show in this final section how some existing empirical work might actually be seen to tie in with my account.

Thomas Zentall (2005, 2006) has recently claimed that demonstrating mental time travel in animals requires presenting them with an unexpected question. This seems to me quite an apposite description of where at least part of the real empirical challenge in this area lies. If the arguments I have offered in this paper are along the right lines, there are a number of types of behaviour over time that animals and children can engage in that can be explained by appeal to processes operating on elements of the individual's model of the world over time – governing, say, their persistence (see section 2), or the order in which they succeed each other (see section 3) – rather than by invoking a grasp, on the part of the individual, of the distinction between past, present and future. Note, though, that this type of explanation seems available only in cases where there are certain stable temporal features in the individual's environment – i.e. the time worms typically take to decay, or the sequence in which certain event-sequences typically unfold – which the individual has already been exposed to, so that timing or sequential learning mechanisms can become entrained to them. Thus, for instance, a child's becoming familiar with certain sequences of events and learning a script for them might simply be a matter of the child learning to perform or think of certain events in a certain temporal order, i.e. do

or think of, first A, then B, and then C. Crucially, though, if a child were to demonstrate that she can also reason about event sequences for which she does not yet have a script because she has not actually encountered them before, the above type of explanation could not be applied.

The key question we should therefore ask is: What are circumstances in which children do have to think about event sequences that they have not encountered before, and about the order of events in those sequences? I think a very good example can be found in studies recently carried out be Cristina Atance (2006). One of the tasks she gave children was to put on an ant costume that consisted of two parts – an ant body and an ant head with large antennae. Crucially, the two parts of the costume have to be put on in a specific order, because if you put the head on first, the body part won't fit over the antennae. Intuitively, it is unlikely that children can recruit an already existing script to solve this task. Rather, it seems that they have to work out the order in which to put on the two parts of the costume.

What does it take to work out the order in which the two parts of the costume have to be put on? Clearly, part of the issue here is that children need to recognize certain spatial facts, such as that the ant head is bigger than the opening at the top of the body. But the kind of reasoning required here is also concerned with a particular sort of causal relationship, namely one in which a particular outcome is dependent on a sequence of events, performed in the right order. The desired effect – wearing the ant costume – is dependent not just on carrying out the two actions of putting on the body and putting on the head, but on putting on the body before the head. I want to suggest that a grasp of these sorts of causal relationships might play quite a basic role in the emergence of the ability to engage in mental time travel.

At the end of the previous section, I suggested that one key developmental question in this context is how children give substance to the distinction between events that are not part of the present scene because they are merely possible, not actual, and events that are not part of the present scene because they belong to the future (or the past). In other words, what makes a certain kind of exercise of the imagination a case of mental time travel, rather than merely a case of travelling between different possible worlds? A grasp of causal relations might provide at least part of an answer here. Clearly, one general thing that distinguishes between other possible worlds and other times is that, whereas there are causal connections between what is the case in the present and what is the case at other times, there is no similar causal connection between the actual world and other possible worlds. But I think there is also a more specific role that the particular type of causal relationship at issue in Atance's experiment plays in making intelligible just how causality and time are connected here.[15] As I said, the causal relationship here is one where a particular outcome is dependent on a sequence of events, performed in the right order. As such, grasping it involves not just the ability to think about (or imagine) first putting on the body and then putting on the head, but also the child's seeing how her wearing the ant-costume depends on events actually happening in that order rather than any other. It is a grasp of this type of constraint, I think, which allows the child herself to give substance to the thought of the events she is thinking about as themselves being arranged in a specific temporal order, rather than her just thinking of them in that order. And this, in turn, allows us to credit her, not just with an ability to imagine

[15] There is in fact a range of the type of 'temporal-causal' relationships exemplified by Atance's task, in which an overall outcome depends on the order in which two or more events happen. Children's understanding of these types of relationships has also been explored, using quite different methodologies in Povinelli et al. (1999) and McCormack & Hoerl (2007). In these studies, children under 4-5 years typically perform quite poorly, indicating a lack of a grasp of the relevant temporal-causal relationships

wearing the ant costume, but with the ability to think about her wearing the ant costume as something that, even though it is not yet the case, will actually be the case in the future.

In other words, understanding the type of causal relationship at issue in Atance's task, in which a particular outcome is dependent on the sequence in which two events happen, involves two things. It involves seeing a connection between what is the case and what could be the case, i.e. how a certain state of affairs might come about. However, at the same time, it also involves seeing why what could be the case is not yet the case. What explains why a certain state of affairs that might actually obtain in the future does not yet obtain is precisely that further things have to happen between now and then in order for it to obtain. We may think that this is a very simple thought, but I think it goes to the heart of the distinction between thinking of an event as one that will (or won't) actually happen in the future, on the one hand, and merely thinking of it as possible.

5. Conclusion

In this paper, I have sought to explain and make plausible one way of understanding the claim that animals and young children are stuck in time and incapable of mental time travel. On this way of understanding, the claim turns on the idea that animals and young children cannot engage in tensed thought. I have contrasted the ability to engage in tensed thought specifically with a more primitive type of sensitivity to temporal relations that involves a variety of processes operating on the individual's model of the world over time, but without distinctions between how things are at different times entering into the model itself. This more primitive sensitivity, I have suggested, can explain a variety of timing and sequential learning abilities. Crucially,

however, it depends on stable temporal features of the environment – how long a certain thing usually takes, or in what order certain types of events usually happen – that the individual has already been exposed to. By contrast, in the final section I introduced a task in which children had to think about, i.e. plan, a sequence of events of a type they had not already come across before. What I sought to bring out in particular was how the ability to think about such a sequence, at least in this case, depends on a grasp of a certain type of causal relationship, in which the overall outcome depends on the order in which two events happen. And I closed with a suggestion as to how a grasp of such causal relationships might be seen to play a key role in the ability to engage in tensed thought, in that it allows the subject to give substance to the distinction between the idea of a possible event, on the one hand, and the idea of an event that will (or won't) actually happen in the future.

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