The Arrow of Mind

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Abstract: Episodic memory provides a peculiarly intimate kind of access to our experiential past. Does this tells us anything about the nature of time, and in particular the basis of time's direction? This paper will argue that the causal theory of temporal direction enables us to unify a number of the key features of episodic memory: its being about particular past experiences, its reliable representation of experiences as past, and the derivative nature of this kind of access to the past: that is, what the memory is about, and how reliable it is, depends on the content and reliability of the original experience on which the memory is based.

1. From mind to time

It is a truism that temporality pervades experience: we see events as fleeting and objects as persisting, we anticipate the longed-for or dreaded, we grieve at our losses, recall the past with nostalgia, attempt to 'live for the present', and so on. Every moment brings with it some fresh reminder of time's dominion over us. In all this, time's true nature may remain hidden. At least, we cannot simply assume that time as it is and time as we experience it are one and the same. Notoriously, both physicists and philosophers have denied that time passes in reality, while conceding that it appears to do so. Might there nevertheless be, somewhere in these familiar psychological phenomena, the basis of an argument for some intrinsic, mind-independent feature of time? I propose here to offer an argument for a particular account of the basis of time's most distinctive feature, namely its direction, from features of a mental phenomenon, episodic memory. Even those who deny that time passes will baulk at denying there is a fundamental asymmetry between time and space. There may be directions in space, but there is no intrinsic spatial direction, which could then constrain the behaviour of objects moving through space. In contrast, there is an important asymmetry (in fact, a number of asymmetries) between earlier and later times. What explains that asymmetry (or asymmetries)? The answer I shall defend is that the direction of time is grounded in the direction, or asymmetry, of causation: if A is a cause of B, then B is not a cause of A (where 'A' and 'B' pick out particular datable events, rather than event types).

The causal theory of time's direction is hardly novel, of course. It has been a very influential theory of time's direction, particularly in the twentieth century (despite attacks on the idea of causation by Bertrand Russell (1912-13) early in the century), when it was defended by Hans Reichenbach (1956), Adolf Grünbaum (1968), Hugh Mellor (1981), (1998), (2009), and Michael Tooley (1997), among others. But it has also had its critics (e.g. Lacey (1968)). I briefly address some of the objections levelled at it below, but my main concern is to provide a positive argument in favour of this well-known but controversial theory. The idea of doing so by means of a psychological phenomenon is not new, either. Mellor (1981, 1998) offers a deductive proof based on certain principles concerning the perception of time order: seeing one event as following another. The phenomenon I focus on,

however, is memory, and more specifically episodic memory, that is memory of our own experiences. And I offer, not a deductive proof (about which one might have certain qualms), but rather an inference to the best explanation. If we assume the causal theory of temporal direction (or at least some version of this), we can, I suggest, explain and unify some of the defining characteristics of episodic memory.

Arguments can be taken in two directions, however. For those who do not like the conclusion, an argument can serve to recommend a revision in our views of what seemed a plausible premise. I want to defend the causal theory. But for those who take the view that it is an unworkable theory may use the argument I present here as grounds for a revision in our view of the structure and mechanisms of episodic memory. Either way, I hope that the argument itself will be of not insignificant interest.

2. The nature of episodic memory

When Proust's Swann tastes the little madeleine biscuit, dipped in tisane (one of the most famous, and also one of the most modest, gastronomic events in literature), scenes from his childhood suddenly appear before him: the people in the village where his aunt lived, the flowers in the park, the church and little houses….or, to speak somewhat less figuratively, the experiences he once had of these things present themselves before his mind's eye. To speak less figuratively still, it is as if those experiences re-present themselves. There is a chain linking his current memory with those experiences in such a way that he is put in touch, in thought, with his own past. The experience is an entirely familiar one. Although it does not always invoke the feelings of intense nostalgia that consumes Swann in that moment of remembering, we do have ready access to our own experiential pasts in this kind of way. The psychologist Endel Tulving (1983) suggested that this is a distinctive kind of memory, which he named 'episodic memory', distinguishing it from what he called 'semantic memory' or memory that, as for example when we remember that the Wars of the Roses ended in 1485. And we can further distinguish these two from practical memory, or remembering how, such as remembering how to play a certain tune on the cor anglais. In making these conceptual distinctions, however, we should be cautious of implying deep psychological differences. There may be quite a bit that these types of memory have in common when it comes to encoding mechanisms, for example (see, e.g., Baddeley (1976)). But from the philosophical point of view, the category of episodic memory is particularly interesting precisely because it defines a certain route to knowledge of, or at last acquaintance with, our pasts, and indeed it is the basis of one philosophical account of how it is that we persist as persons through time (Locke (1689), II.xxvii.9-10).

So let us define the characteristic features of episodic memory which make it so important and interesting. Episodic memory connects us with our past in a way that is at least capable of providing us with knowledge of our pasts, rather than mere belief. The best ground you have, indeed, for thinking that you had a certain experience, with its characteristic phenomenology, is remembering the episode 'from the inside' (this striking and entirely apt phrase we owe to Shoemaker (1970), p. 273: the idea is that the memory carries with it a

sense that I had the experience). A report dating from the time that you had had the experience in question would not have the same authority, as it could not convey as effectively as a memory the perhaps ineffable and publicly incommunicable phenomenology of the original experience. But, in putting us in touch with our own past experiences, it also puts us in touch with the past events which originally prompted those experiences. There are a number of features here, which we might attempt to disentangle as follows:

(i) Singular thought. The first characteristic of episodic memory is that it not only gives us information about past experiences, it allows us to have singular thoughts about them. Your memory is of that particular experience (e.g. of seeing the solar eclipse while visiting the Channel Islands in August, 1999). Although this might involve semantic memory (remembering that there was an eclipse on that date), describing it in such terms does not imply a connection with any particular experience.

(ii) The reliable sense of pastness. As Russell observed, memories provide us with an awareness that the remembered event is past, rather than present, and also, typically, provides us with information about how past the event is. He talks cautiously of a 'feeling of "pastness"', and perhaps this comes in degrees, but he also suggests that we locate remembered events in the more or less distant past by their associated context. The more recent the event, the greater the accompanying context. (Russell (1921), p. 162.) At any rate, whatever the mechanism, we have to agree with Russell that memories can lead more or less directly to the belief that the remembered event is past, and, moreover, that as long as we are not mistaken in our belief that the event occurred, we cannot be mistaken that the event is past: the intimation of pastness is a reliable one.

(iii) Derivative epistemic status. Memory not only provides us with knowledge of our pasts, it also provides us with knowledge of past external events: of what was going on when we had the original experience on which the memory is based. But insofar as our knowledge is memory knowledge (as opposed to knowledge only partly based on memory), its epistemic status – that is, its counting as knowledge – is derivative: it depends on the fact that the original experience afforded knowledge of the external event in question. Episodic memory does not provide us with an independent route to knowledge of the past. This derivative status itself breaks down into two asymmetric aspects: (a) content: there is no part of the content of an episodic memory (qua memory) that is not also part of the content of the original experience, but there can be (and often is) part of the content of the experience which is not contained in the memory; (b) reliability: the memory is not more reliable than the experience, though the experience can be more reliable than the memory. (Campbell (1994) calls this the 'stepwise' character of memory.)

We should probably hesitate before taking the above conditions to constitute a conceptual analysis of episodic memory, that is, as providing the necessary and sufficient conditions for something to count as an episodic memory. No doubt other conditions could be imposed. It might be insisted, for example, that such memory requires a persisting subject, so

that we can identify the rememberer with the subject of the original experience (for a response to this point, see Shoemaker (1970)). And there may be occasions that we would want to count as remembering, even though they did not provide knowledge (Bernecker (2007)). As for the 'feeling of pastness', we might perhaps have an image in our minds which we are not sure we can identify as a genuine memory or an imaginative projection, in which case we would suspend belief on whether or not the image represents a past event. But we can set these scruples to one side for present purposes. It would be enough that paradigm instances of episodic memory satisfy the above criteria. But there is a more fundamental objection, and that is that the characterisation above rests on a rather passive conception of memory as information storage and retrieval, rather than a much more active reconstruction of a past event, perhaps based in part on subsequent information. That not only queries the epistemic status of the memory (is this really knowledge of the past, or a well-informed conjecture?), but also condition (iii): surely the content of what is presenting itself as a memory may outstrip the content of the original experience? That is, the memory of the event may well be informed by what we subsequently learn of the event. But for the purposes of the argument I wish to pursue in this paper, I propose to circumvent these empirical issues concerning the mechanisms underlying the phenomenology of what present itself to us as memory, by making a conceptual point: insofar as memory is truly episodic, that is, to the extent that it presents to us the content of an experience that we actually had, its content cannot outstrip the content of the original experience. To put it another way, the specifically episodic character of the memory is associated only with the content that the memory has in common with the original experience. It thus becomes a matter of conceptual necessity that a genuinely episodic memory meets condition (iii) above, so that this condition really could appear in a conceptual analysis of memory. The consequence of this way of putting things is that we may, when examining a memory, be unable to discern the genuinely episodic element from those that are part of the reconstruction. But this need not stand in the way of characterising memory as providing knowledge, or at least warranted true belief, concerning our experiential pasts, for there can still be a reliable connection between the memory and the original experience.

I shall proceed, then, on the assumption that (i)-(iii) capture at least paradigmatic instances of episodic memory. The question I want to pursue in the latter part of this paper is whether we can offer a more or less unified explanation of these features. I believe we can, in terms of causality. A famous paper by C.B. Martin and Max Deutscher (1966), laid the foundations of a causal theory of memory, but I believe that the role of causation is even more extensive than they suggested.

So, having defined our starting point, namely the characteristic features of episodic memory, let us turn to what will be the conclusion of the argument to the best explanation.

3. Causation and the arrow of time

The 'arrow', or direction, of time is the direction from earlier to later times. It is of greater interest than any direction we might define with respect to space (for example, the left-right

direction) because it is thought to constrain processes in time, and so not something that is purely conventional, or due to contingent features of the environment. The direction of time makes itself felt in a variety of ways, not least in our own experience: of the sense that the past is receding away from us and that we are moving towards the future, and (though perhaps this is an aspect of the very same phenomenon) the accumulation of memories. This is not readily attributable to local, variable factors, but suggests some deeper asymmetry. There is no comparable phenomenon for space. The direction from up to down, admittedly, also constrains what happens (it is the direction in which things tend to fall), but that is because it is (typically) defined relative to the centre of the Earth, and then the determining constraint is gravity, rather than some asymmetry in space itself.

Direction, then, does seem to be an integral aspect of time in a way that is not mirrored by space. But that it is not to say that it is an irreducible aspect of time. One candidate for providing the reductive base is causation. Here is the most basic reductive analysis:

Causal Theory Mark I: x is earlier than y if and only if x is a cause of y

This provides a reductive analysis of time order: the relation of temporal precedence is identified with the relation of causal order. Reduction does not require that a given cause of y is unique. x's being earlier than y entails only that x make some causal contribution to y. The analysis is also, to some extent, neutral on the question of causal relata. At least, the analysis is silent on whether the relata are events or states of affairs. But they do have to be readily datable items. It is not clear that the analysis is well adapted to cope with agent causation, for instance. But assuming that the kind of causation we are interested in, as far as defining the asymmetry of time is concerned, is event or state causation, there is a quite fundamental objection to the Mark I theory. Causality, it will be urged, is less pervasive than temporality. Although a causal connection may be sufficient for temporal priority, it does not appear to be necessary. We could imagine establishing, by means of light signals, that one spatially distant event was prior in time to some other distant event, even though the distance between them precluded one from influencing the other. Suppose we are equidistant from two light reflectors, A and B, two light-seconds apart from each other. At t, a beam of light is sent to A, and at t + 1 second, another beam is sent to B. The first light beam returns from A at t + 3 seconds, and the second light beam returns from B at t + 4 seconds. We can infer that the moment at which the first beam reached A is one second earlier than the moment at which the second beam reached B. But as these two events were two light-seconds apart in distance, and no influence propagates faster than light, the first event cannot have influenced the second.

It would be possible for the causal theorist to dig their heels in, and insist that such counterexamples to the theory are merely apparent, and that we are not forced to attribute an order to causally unconnected events. But such a move, though heroic, would rather diminish the attractiveness of the theory.

The objection that causality is less pervasive than time can however be dealt with by introducing the simultaneity relation, as follows:

Causal Theory Mark II: x is earlier than y if and only if x is simultaneous with a cause of y

This no longer requires that x and y be directly causally connected, though since simultaneity is reflexive, it includes the cases where they are. (Admittedly, since simultaneity is not defined, we are not being offered here a thoroughly reductive account of temporal relations. But we are given a reductive account of temporal precedence.) But now the notion of simultaneity has been introduced, we have to ask whether it is absolute or relative simultaneity. Some flexibility here is surely desirable, as causal theorists would not typically want to be at odds with the standard interpretation of the Special Theory of Relativity. So, if desired, the relativity to inertial frames could be made explicit:

Causal Theory Mark III: x is earlier than y relative to some inertial frame F if and only if x is simultaneous relative to F with a cause of y

What this rules out is a case where a cause and effect are simultaneous with respect to an inertial frame, given the reasonable assumptions that simultaneity is symmetric and transitive. Suppose, then, for reductio that the following obtain:

(1) x causes y
(2) z is simultaneous relative to some frame F with both x and y

Given symmetry and transitivity, it follows from (2) that x is simultaneous with y in F. But it also follows from (1) and the Mark III theory that x is earlier than y in F. And so we get a contradiction. Given that causation is not itself frame-relative, (1) now rules out (2) for any inertial frame.

A vestige of the objection to the Mark I theory remains, however. Could there not be a temporal ordering in the absence of any causal connections anywhere? Suppose we subscribed to an absolutist conception of time (or, as it is sometimes called, a substantivalist or Platonist theory), according to which time exists independently of anything else that exists or happens in time (see, e.g., Newton-Smith (1980) for discussion). A world without events, or states of affairs, could still, on this conception, be a temporal world. But in the absence of items to provide relata for the causal relation, there would be no causality. To accommodate this, we need to distinguish between time order and time direction. Let us concede that time in the absence of causally related events or state of affairs would still constitute an ordered series. Order in such a series could be constituted by nothing more than a betweenness relation. That B is between A and C, and C between B and D gives us the ordering ABCD, but does not confer a direction. That is, we are not invited to read the order as going from A to D rather than D to A, just as no spatial gradient is describable in any non-perspectival sense as ‘uphill’ rather than ‘downhill’. What confers direction, and so an asymmetry between contiguous times, is causality. It would be quite consistent, then, to say that time without causality is an ordered series, but no time stands in the earlier relation to any other.

The causal theory does not collapse an acausal absolutist universe to a single instant. So we do not need to make a further adjustment to the theory to accommodate absolutism.

A final qualification: in offering any of these analyses, the causal theorist is not (or need not be) proposing a conceptual or analytic reduction of time to causation. Rather, what is offered is a theoretical reduction (Sklar (1981)). What recommends it is not a view about the meaning of temporal expressions, but rather what explanatory work it can be put to.

These refinements are not essential to the argument that follows, as that argument does not distinguish between the different versions of the causal theory of time's direction. All that is required is that temporal priority is grounded in causal priority. The point of displaying the different versions was simply to remove certain obstacles to a causal account, so that the argument that follows was not assumed to be leading towards an already discredited theory.

4. Meeting the conditions for episodic memory

Now let us return to the characteristic conditions for (paradigm) episodic memory outlined earlier, and ask how they might be met. Take the first characteristic, that episodic memory constitutes singular thought about past experience. What enables us to pick out that very experience, rather than one very like it? It cannot simply be the correspondence of content between memory and experience, for the memory might correspond in terms of content to an exactly similar experience, had on a different occasion, perhaps, and now forgotten. If the exactly similar experience is question has been forgotten, then the memory cannot, by definition, be of that other experience. So if it is not content alone that guarantees singular thought, there is no more plausible candidate than an unbroken causal connection between experience and memory, for it is that which distinguishes the remembered from the forgotten experience. And this, indeed, has been the favoured account of singular thought since Kripke's (1972) critique of the description theory of reference.

What now of the second characteristic, that episodic memory is accompanied by a reliable sense of pastness? This cannot be a purely phenomenological feature, which would not represent pastness, since, being purely phenomenological, it would represent nothing. (In contrast, according to intentionalism, the phenomenology is determined by the content.) So perhaps all we need to account for this aspect of memory is that memory is accompanied by a past-tensed belief, e.g. that I had the experience of tasting the madeleine. (And we might offer a similar conception of the way in which perception intimates presentness. It is not that we can perceive presentness, any more than we can perceive pastness, but rather the perception is accompanied by a present-tensed belief.) So the sense of pastness by itself need be no mystery. However, it is also a reliable sense of pastness, and this does take more explaining. When I believe that an experience is past, I must believe truly. Moreover, it cannot simply be an accidentally true belief, one that turns out to be true by coincidence. There must be a connection between the way in which we acquire the belief about our past experience, and whatever it is that makes that belief true. This is the cornerstone of the causal theory of knowledge (which makes, of course, a natural companion to the causal theory of

singular reference/thought). Its simplest expression would be this: for a belief to count as knowledge, its truth-maker (whatever bit of reality is sufficient for its truth) must be one of the causes in the process leading to the acquisition of that belief. But this will need to be refined somewhat, if, for example, we want to allow for knowledge of the future, on the basis of present observation. Given the relevant astronomical knowledge, we are able to predict, very precisely, the time of a solar eclipse the places with respect to which it is a total eclipse, and those for which it is partial. We can therefore be said to know that, e.g., the eclipse will take place on 3rd September, 2081. The truth-maker for this, however (the eclipse itself), lies in the future, and so cannot be a cause of our beliefs. To accommodate this, the causal theory of knowledge could be adapted as follows: for a belief to count as knowledge, the truth maker must either be among the causes of the belief, or logically connected to those causes. In the case of the eclipse, the truth-maker is necessitated by the facts by virtue of which the belief was generated. This amendment to the account may accommodate cases where the truth-makers are not the kind of thing that can themselves be causes (truth-makers concerning numbers, for example).

So, how might this apply to the memory belief that a certain experience is past? We need, first, to identify the truth-maker, for this we need to have an explicit semantics for past-tensed belief. Here is the most obvious semantics we might offer:

> A token belief, 'I tasted a madeleine', had by x, is true if and only if x tasted a madeleine

Call this the tensed account, since it retains the past tense on the right-hand side of the analysis. In metaphysical terms, the truth-maker for the belief is a property of the experience, its pastness, or perhaps the fact that the experience is past. If, however, we want to bring out the context sensitivity of belief (and perhaps are suspicious of such properties as pastness, or past-tensed facts), we might offer the following:

> A token belief, 'I tasted a madeleine', had by x, is true if and only if x tastes a madeleine earlier than the token belief

Call this the token-reflexive account, because it includes the timing of the token belief itself in its own truth-conditions. The truth-maker is just the fact that the experience is had earlier than the memory belief. Now, whichever of these accounts we choose of the truth-conditions, and truth-makers, of memory beliefs, for those beliefs to be reliable, there has to be some way of relating the truth-makers to the causal process by which the beliefs are generated. It is not immediately obvious how this is to be done, but that is the challenge.

Now for the third characteristic: that episodic memory provides knowledge of the past in a derivative way. Here, we are looking for a connection between the original experience and the memory which allows the experience to confer its epistemic status onto the memory. Or, to put it another way, which makes the memory depend for its authority on the original experience. There were two aspects to this. One was in terms of content: the memory depends for its content on the experience, not vice versa. The memory is of tasting the madeleine

because the original experience was of tasting the madeleine. Content propagation is a causal process, so, for the memory to depend asymmetrically on the experience for its content, causation itself must be fundamentally asymmetric. And that correspondence of content means that there must be a connection between the truth-makers of the experience and memory (or rather their respective beliefs). Since both memory and experiential beliefs are singular thoughts about a particular experience, that experience must enter into the truth-makers of both. So the memory can only have a truth-maker if the original experience does.

We now have at least a sketch of what it would take for the various conditions for paradigm episodic memory to be satisfied. Is there a way in which these conditions can be not only met, but also unified? That is the burden of the next section.

5. Memory and the causal arrow of time

Episodic memory exhibits a causal structure: the original experience and accompanying experiential belief causes the later memory and accompanying memory belief. That causal connection is what allows the memory belief to be a singular thought about the original experience. So the first condition can be seen to be satisfied before we start raising any questions about the nature of time. But now look what happens when we introduce the causal theory of time direction. The fact that the experience caused the memory entails, by that theory, that the experience is earlier than the memory. And according to what we called the 'token-reflexive' semantics' for tensed belief, this is sufficient to guarantee the truth of the memory belief that the experience is past. The causal theory of time direction thus unifies the first two conditions for episodic memory. The causal link between experience and memory that allows the memory to be a singular thought about the experience also grounds their time order, which in turn provides the truth-maker for the memory belief. Reliability requires more than truth, of course: there must be a close connection between the truth-maker and the process by which the belief is generated. But this too is satisfied, for the causal process by which the memory belief is generated by the original experience—i.e. the fact that the experience is a cause of the memory—is itself the truth-maker for the memory belief that the experience is past!

So the causal theory offers an explanation both of how the first two conditions for memory can be met and how they are linked. But is it necessarily the best explanation? (For after all, this is supposed to be an inference to the best explanation.) It might be urged that, although to understand the nature of memory we have to subscribe to the view that causes are earlier than their effects, we do not need to take a stance on whether it is causal priority that grounds temporal priority, or vice versa. Suppose we agree with Hume that the only objective asymmetry in causation is temporal priority, the relation between cause and effect being otherwise symmetrical ((1739-40), Book I, §XV). It would then follow entirely trivially that a memory was later than the experience on which it was based. The Humean account would, however, fail to explain an important asymmetry between the memory and the experience. And this is where the third characteristic of episodic memory is relevant. There is an asymmetry of dependence in terms of content: there is no part of the content of a (genuine)

episodic memory of an experience that is not also part of the content of the original experience. Any additional content the memory has is extraneous to the memory qua episodic memory. But the original experience may well have content that is not represented in the memory. This asymmetry must surely indicate a causal asymmetry: the content of the memory derives from the experience, not vice versa. But this can hardly be due to the mere fact that we call the earlier event 'cause' and the later one 'effect'. Mere temporal asymmetry is powerless to explain the asymmetry of content dependence. So either the temporal asymmetry derives from the causal asymmetry (as the causal theory of time direction asserts) or the two asymmetries are logically independent, in which case their coincidence is mysterious. So the causal theory of temporal priority provides a much more satisfying account of the structure of episodic memory than does its inverse, the temporal account of causal priority.

The final piece of the jigsaw is the asymmetry of reliability: the memory is not more reliable as a route to knowing what actually happened in the past than was the original experience, though the original experience might be more reliable than the memory. Here we are interested, not simply in what experiences we had, but what events those experiences were witnesses to. For either memory or experience to be reliable, there must be a causal connection to their truth-maker. The truth-maker in question is the past event (the eclipse, for example). And that event features in the causal story of both memory and experience. But it only features in the causal story of the memory because it features in the causal story of the experience, since the causal route from event to memory goes via the experience. The asymmetry of reliability thus requires, again, the objective asymmetry of causation, on which the causal theory of time direction depends.

In case it might otherwise be thought that I was guilty of a sleight of hand in the account offered a couple of paragraphs back, let me bring something out into the open. I appealed above to the token-reflexive analysis of past-tensed beliefs: a token of 'x is past' is true if and only if x is earlier than the token. It was this, combined with the causal theory, which guaranteed the veridicality of the sense of pastness in episodic memories. But there is, as we saw, a rival semantics, namely the tensed account, and for some theorists it is the preferred semantics. Surely, they will urge, it is the objective, non-perspectival pastness of experiences that makes our beliefs that they are past true. For time (they continue) really does pass: events are first present, and then past, and memory is one of the psychological indicators of this passage. Where does that appear in our account? The short answer is: it doesn't. I am quite unapologetic about that. I have not, it is true, provided any demonstration of the incoherence, or unfeasibility, of any account of memory which does appeal to the passage of time. But I have laid out some, at least, of the desiderata which such an account needs to satisfy. If we can satisfy those desiderata without any appeal to the passage of time, then perhaps we might draw a further (if cautious) moral from this discussion about what the mysterious but indubitable arrow of time amounts to—and what it doesn't.

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