Against Perrin's Embodied Causalism: Still no Evidence for the Necessity of Appropriate Causation

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ABSTRACT. Perrin (2021) has two main goals. First, to attack the simulation theory of memory on its empirical home turf. Second, to defend a novel embodied causal theory of memory designed to avoid the empirical difficulties that beset both the classical causal theory of memory and—if Perrin is right—the simulation theory of memory. In pursuit of his first goal, Perrin argues that the empirical evidence to which simulationists appeal does not in fact support simulationism. In pursuit of his second goal, he argues that that very evidence supports causalism in general and, moreover, that additional empirical evidence supports an embodied form of causalism in particular. This paper likewise has two goals. First, to critique Perrin's attempt to show that the evidence to which simulationists appeal supports causalism rather than simulationism. Second, to show that, regardless of whether Perrin is successful with respect to his first purpose, he is unsuccessful with respect to his second—to show, that is, that the additional evidence that he adduces fails to provide any support for the necessity of the sort of embodied appropriate causation that figures in the embodied causal theory. If the paper achieves its two goals, embodied causalism is in the same empirically-leaky boat as more traditional forms of causalism, and the empirical evidence continues to favour simulationism over causalism.

Keywords: Episodic memory; causal theory of memory; simulation theory of memory; embodied cognition; memory traces.

RÉSUMÉ. Perrin (2021) a deux objectifs principaux. Premièrement, attaquer la théorie simulationniste de la mémoire sur son terrain empirique de prédilection. Deuxièmement, défendre une nouvelle théorie causale incarnée de la mémoire, une théorie conçue pour éviter les difficultés empiriques qui assaillent à la fois la théorie causale classique de la mémoire et, si Perrin a raison, la théorie simulationniste de la mémoire. Dans la poursuite de son premier objectif, Perrin maintient que les preuves empiriques auxquelles les simulationnistes font appel ne soutiennent pas en réalité le simulationnisme. Dans la poursuite de son deuxième objectif, il maintient que ces mêmes preuves soutiennent le causalisme en général et, en outre, que des preuves empiriques supplémentaires soutiennent une forme incarnée de causalisme en particulier. Le présent article a également deux objectifs. Premièrement, critiquer la tentative de Perrin de montrer que les preuves auxquelles les simulationnistes font appel soutiennent le causalisme plutôt que le simulationnisme. Deuxièmement, montrer que, indépendamment du fait que Perrin réussisse ou non à atteindre son premier objectif, il échoue à atteindre le second – autrement dit, montrer que les preuves supplémentaires qu'il invoque ne soutiennent pas la nécessité du type de causalité appropriée incarnée qui figure dans la théorie causale incarnée. Si l'article atteint ses deux objectifs, le causalisme incarné se trouve dans la même situation problématique du point de vue

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empirique que les formes plus traditionnelles de causalisme, et les preuves empiriques continuent de favoriser le simulationnisme plutôt que le causalisme.

Mots-clés : Mémoire épisodique, théorie causale de la mémoire,   théorie simulationniste de la mémoire, cognition incarnée, traces mnésiques.

I – INTRODUCTION

Perrin (2021) has two main goals. First, to attack the *simulation theory of memory* (Michaelian, 2016b) on its empirical home turf. Second, to defend a novel *embodied causal theory of memory*[1] designed to avoid the empirical difficulties that beset both the classical causal theory of memory (Martin & Deutscher, 1966; Bernecker, 2008, 2010) and—if Perrin is right—the simulation theory of memory. In pursuit of his first goal, Perrin argues that the empirical evidence to which simulationists appeal does not in fact support simulationism. In pursuit of his second goal, he argues that that very evidence supports causalism in general and, moreover, that additional empirical evidence supports an embodied form of causalism in particular. This paper likewise has two goals. First, to critique Perrin's attempt to show that the evidence to which simulationists appeal supports causalism rather than simulationism. Second, to show that, regardless of whether Perrin is successful with respect to his first purpose, he is unsuccessful with respect to his second – to show, that is, that the additional evidence that he adduces fails to provide any support for the necessity of the sort of embodied appropriate causation that figures in the embodied causal theory. If the paper achieves its two goals, embodied causalism is in the same empirically-leaky boat as more traditional forms of causalism, and the empirical evidence continues to favour simulationism over causalism.

The paper is structured as follows. Section 2 provides a brief review of the causalist-simulationist debate. Section 3 critiques Perrin's attempt to show that the evidence to which simulationists appeal does not in fact support simulationism. Section 4 critiques his attempt to show that the very evidence to which simulationists appeal instead supports causalism in general. Section 5 critiques his attempt to show that additional evidence supports embodied causalism in particular. Section 6 briefly sums up.

2 – THE CAUSALIST-SIMULATIONIST DEBATE

Perrin (2021) fires the latest salvo in the ongoing causalist-simulationist debate. Since that debate has recently been reviewed in detail elsewhere (Michaelian & Robins, 2018), only a brief review is required here.

Schematically, the debate can be seen as having the following structure. Classical causalists (*e.g*., Martin & Deutscher 1966; Bernecker 2010) initially appeal to the *intuitions* elicited by certain hypothetical cases—such as the "hypnotist" and "friend" cases discussed below—to argue for the causal theory of memory. Simulationists (Michaelian, 2016b)[2] appeal to *empirical evidence*, first, for the reconstructive character of memory retrieval and, second, for the

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[1] The embodied causal theory can be seen as a refinement of the procedural causal theory developed by Perrin (2018).
[2] See De Brigard (2014) and Shanton & Goldman (2010) for simulation theories that are less clearly opposed to causalism than is the theory developed by Michaelian (2016b).

place of remembering as a form among others of mental time travel to argue for the simulation theory of memory. Causalists then respond to the simulationist challenge.

One possible response is to argue that the causal theory is meant to capture our concept of memory—as opposed to memory understood as a natural phenomenon—and that the empirical evidence on which the challenge is based is therefore irrelevant. But causalists generally mean for their theory to capture the phenomenon of memory and not merely the concept of memory, and this response has been relatively unpopular. The more popular response has been to argue either that there is empirical evidence in favour of the causal theory (though perhaps not in favour of the classical causal theory) or that there is empirical evidence against the simulation theory (or both). Perrin's argument amounts to a version of this response.[3]

Causalists and simulationists disagree on a number of points, but the core issue that divides them concerns the necessity of *appropriate causation*. According to the classical causal theory of memory (C-CTM),

A subject S remembers an event e iff

> S experienced e when it occurred;
>
> S now represents e;
>
> S's current representation of e is appropriately caused by his previous experience of e, where:
>
> > S's current representation of e is appropriately caused by his previous experience of e $=_{df}$ S's current representation of e is caused by a memory trace originating in S's previous experience of e.

A *memory trace*, in turn, is understood as an entity that provides at least some of the content of the representation that it causes. C-CTM thus corresponds to a familiar encoding-storage-retrieval conception of the memory process, a conception on which remembering involves the transmission of content from experience to retrieved representation.

Perrin refers to this conception as "transmissionism". Since he ultimately wants to make room for a form of transmissionism that makes no reference to experiential content, it will be convenient to refer to this conception as "c-transmissionism" (for "classical transmissionism"). Note that c-transmissionism, as Perrin defines it, is more demanding than the form of transmissionism described by Michaelian and Sant'Anna (2021). As Michaelian and Sant'Anna define it, transmissionism is the general view that remembering involves the retrieval of stored content, regardless of where that content originates. To say that a view is transmissionist, in Michaelian and Sant'Anna's sense, is thus not to say that it is a classical causalist view—the simulation theory, in particular, acknowledges that remembering involves the retrieval of stored content and is thus a transmissionist view, in the relevant sense.[4] As Perrin defines it, c-transmissionism is the more specific view that remembering

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[3] See Robins 2020 and Werning 2020 for other versions.

[4] Though see section 6 on embodied simulationism.

involves the retrieval of stored "endogenous" content, content that, first, originates in the subject's experience of the remembered event and, second, stays within the subject between the time of experience and the time of retrieval (ruling out the sort of external loop that figures in the friend case). To say that a view is c-transmissionist is thus just to say that it sees appropriate causation, as understood by C-CTM, as being necessary for the occurrence of genuine remembering—to be a c-transmissionist is to be a classical causalist, and vice versa.

According to the simulation theory of memory (STM),[5]

> S remembers e iff
>
>> S now represents e;
>>
>>> S's current representation of e is produced by a properly functioning and hence reliable episodic construction system that aims to produce a representation of an event belonging to S's personal past.

There is much that could be said about the motivations for and consequences of STM, but what matters, for present purposes, is the ways in which it disagrees with C-CTM. One way in which the two theories disagree is that C-CTM includes a previous experience condition, whereas STM does not; that is, STM allows, and C-CTM does not allow, that one might remember an event that one has not experienced. There has been little discussion of this issue so far.[6] Another way in which they disagree is that C-CTM holds that appropriate causation is necessary for the occurrence of genuine remembering, whereas STM does not; that is, STM allows, and C-CTM does not allow, that one might remember an event even if one's current representation of the event is not appropriately causally connected to one's previous experience of it—in other words, that c-transmissionism is false. This is the issue on which most discussion has focussed.

3 – DOES THE EVIDENCE SUPPORT SIMULATIONISM?

With this background in place, this section considers Perrin's attempt to show that the evidence to which simulationists appeal does not support simulationism.

The basic argument for STM—and, in particular, against the necessity of appropriate causation—appeals to two bodies of empirical evidence (Michaelian 2016b). First, evidence for the reconstructive character of *memory retrieval* suggests that remembering can occur in cases in which a minority of the content of the retrieved representation is new. If we accept that remembering can occur in cases in which only a minority of the content is new, there is no non-arbitrary reason to deny that it can occur in cases in which a majority of the content is new. And if we accept that remembering can occur in cases in which a majority of the content is new, there is no non-arbitrary reason to deny that it can occur

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[5] Michaelian (2021) defends an updated version of the simulation theory that departs from that developed by Michaelian (2016b) in significant respects. As the issues to which the updated version of the theory is meant to respond are not directly related to those discussed here, it will be convenient to focus on the earlier (and simpler) version of the theory.

[6] But see McCarroll (2020) for a causalist challenge to simulationism based on the latter's rejection of the previous experience condition.

in cases in which the entirety of the content of the retrieved representation is new. But if we grant that remembering can occur in cases in which the entirety of the content of the retrieved representation is new, we have in effect rejected the necessity of appropriate causation. Second, evidence on memory as a form of *mental time travel* likewise suggests that remembering can occur in which the entirety of the content of the retrieved representation is new: there is good empirical reason to treat memory as a form of mental time travel like others; other forms of mental time travel—including future thought—do not require appropriate causation; this suggests that memory does not require appropriate causation. We will discuss reconstruction and mental time travel in more detail in the following section; the point to note, for now, is that this *anti-necessity argument* rests not on an appeal to intuitions but on empirical evidence.

Responding to the anti-necessity argument, Perrin argues that

> what the empirical evidence on which STM draws affords, strictly speaking, is the *weakly* anti-[transmissionist] conclusion that *some* of the content of an episodic memory can be exogenous. The step that leads from weak to *strong* anti-[transmissionism], namely the slipping move, is conceptual. Again, the slipping move goes from two empirical pieces of evidence—the inclusion of *some* exogenous content into remembering and the remembering-imagining similarity—to the conclusion that remembering does *not* need *any* transmitted content *at all*, while one would expect the conclusion that it does *not* need *exclusively* endogenous content. The only reason I can see for the step leading to the non-necessity conclusion is that the conceptualization of remembering as a species of imagining dispenses with positing any transmission of endogenous content. But, again, this conceptual possibility is not implied by the empirical data. (236)

In a nutshell, Perrin maintains that, while the empirical evidence cited by the simulationist does indeed demonstrate that remembering is compatible with the inclusion of *some* nonendogenous content, this does not entail that remembering is compatible with the inclusion of *only* nonendogenous content, which is the entailment that is needed if the simulationist is to be entitled to arrive at the conclusion that appropriate causation is not necessary for remembering. He thus suggests that the conclusion of the simulationist's anti-necessity argument rests not only on empirical evidence but also—like the conclusion of the causalist's necessity argument[7]—on intuition.

Now, Perrin is certainly right that the empirical evidence does not *entail* that remembering is compatible with the inclusion of only nonendogenous content (and thus that appropriate causation is not necessary for remembering). The aim of the anti-necessity argument is not, however, to show that it does. Instead, the argument aims, more modestly, to demonstrate that the empirical evidence *suggests* that remembering is compatible with the inclusion of only nonendogenous content (and thus that appropriate causation is not necessary for remembering).

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[7] See section 5.

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In concrete terms, the simulationist argues that what we know about the reconstructive character of *memory retrieval* makes it highly probable that most if not all apparent memories—including apparent memories that are not plausibly treated as confabulatory or otherwise erroneous—include at least some nonendogenous content, that many include mostly nonendogenous content, and that some include only nonendogenous content. The causalist claims that those apparent memories that include only non-endogenous content are not genuine. The simulationist's argument shifts the burden of proof: while the causalist's claim is intuitively plausible, he owes us an empirical reason for it. Absent such a reason, we ought to endorse the opposed claim that, if a properly-functioning episodic construction system produces a representation of an event belonging to the subject's personal past, then that representation is a genuine memory, even if it includes only nonendogenous content.

Similarly, the simulationist argues that what we know about *mental time travel* suggests that the system that underwrites both memory and future thought—the episodic construction system—is simply not designed in such a way that, if it functions properly, and if it aims to produce a representation of an event belonging to the subject's personal past, then it necessarily incorporates content originating in the subject's experience of that event into the representation that it produces. The causalist claims that, if the system does not incorporate such content, the representation is not a genuine memory. Again, the simulationist's argument shifts the burden of proof: while the causalist's claim is intuitively plausible, he owes us an empirical reason for it. Absent such a reason, we ought, again, to endorse the opposed claim that, if the episodic construction system functions properly, and if it aims to produce a representation of an event belonging to the subject's personal past, then the representation that it produces is a genuine memory even if does not include content originating in the subject's experience of the event.

In short, the anti-necessity argument, while it does not decisively establish the view that remembering is compatible with the inclusion of only nonendogenous content, does make an empirical case for that view. It thereby puts the ball in the causalist's court. The causalist cites intuitions that entail that remembering is incompatible with the inclusion of only nonendogenous content. The simulationist cites empirical evidence that does not entail but that does suggest that remembering is compatible with the inclusion of only nonendogenous content. Anyone interested in theorizing the phenomenon of memory and not merely the concept of memory will grant that empirical evidence trumps intuition. It is thus up to the causalist—unless he is willing to claim that his theory is meant to capture our concept of memory, as opposed to memory understood as a natural phenomenon—to provide empirical evidence in support of the claim that remembering is incompatible with the inclusion of only nonendogenous content and hence that appropriate causation is necessary for genuine memory.

4 – DOES THE EVIDENCE SUPPORT CAUSALISM?

Few contemporary causalists are willing to claim that their theory is meant merely to capture our concept of memory, and they have thus tended to react to the anti-necessity argument by arguing that there is empirical evidence in support of the claim that appropriate causation is necessary for genuine memory.

Indeed, Perrin himself seems tacitly to recognize that the anti-necessity argument succeeds in putting the ball in the causalist's court, as he devotes the greater part of his article to attempting to provide such evidence. He argues first, that the very evidence cited by simulationists supports causalism in general and, second, that additional empirical evidence supports an embodied form of causalism in particular. This section considers the first of these arguments. The following section considers the second.

While he has elsewhere (Perrin, 2016) given more extensive arguments for the existence of various empirical differences between remembering and imagining,[8] Perrin (2021) explicitly argues that empirical research on memory as a form of mental time travel favours the claim that remembering is incompatible with the inclusion of only nonendogenous content and hence that appropriate causation is necessary for genuine memory. He points out, in particular, that Schacter and Addis, in their foundational 2007 paper on mental time travel,

> acknowledge an important difference between remembering and imagining, namely the lower cognitive cost engaged by the former relative to the latter. Reconstructing an event experienced in the past turn out to be cognitively easier than constructing a novel imagined one. Now, such an empirical fact lends strong support to the idea that as far as remembering is concerned, something transmitted from the past experience is operative in remembering and decreases the required cognitive cost, while as far as imagining is concerned, no such transmission occurs, hence the cognitive cost is higher. […] [T]he very same empirical literature to which STM appeals with a view to arguing against the necessity of [transmissionism] provides empirical support for the latter claim, since it suggests that there *is* a causal dependence of the reconstruction of the representation of an event on the past experience of that event. (237-238)

There are two obvious questions about this argument. Do the empirical findings reviewed by Schacter and Addis—along with the empirical mental time travel literature more generally—indeed support the claim that remembering necessarily involves *transmission*? And, if they do support that claim, then of *what* do they suggest that we should take remembering necessarily to involve the transmission?

The first of these questions has been discussed at length in the context of the ongoing debate pitting *continuists*, who maintain that there is no qualitative difference, other than temporal orientation, between remembering the past and imagining the future, and *discontinuists*, who maintain that there is such a difference. Despite the increasingly voluminous literature on the continuism-discontinuism debate (Addis, 2020; Debus, 2014; Langland-Hassan, 2021, forthcoming; Michaelian, 2016a; Michaelian, Perrin, & Sant'Anna ,2020; Munro, 2020; Perrin, 2016; Perrin & Michaelian, 2017; Robin,s 2020; Sant'Anna ,2021; Schirmer dos Santos, McCarroll,, & Sant'Anna ,forthcoming), the debate shows no sign of abating, as continuists appeal to qualitative

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[8] See Michaelian (2016a) for a detailed response to Perrin (2016).

similarities between the processes of remembering and imagining (*e.g*., activation of the same brain regions in remembering the past and imagining the future) in support of their view, dismissing the differences between them (e.g., greater or lesser activation of certain brain regions in remembering the past or imagining the future) as merely quantitative, while discontinuists take those differences to underwrite a qualitative difference between remembering and imagining.

Given that, while it may be possible to prise them apart, continuism aligns at least roughly with the simulation theory and discontinuism with the causal theory, a full response to Perrin's argument must await the resolution of the continuism-discontinuism debate. There is nevertheless reason to suspect that the kind of evidence to which discontinuists appeal and to which Perrin appeals in arguing for the claim that empirical research on memory as a form of mental time travel favours the claim that remembering is incompatible with the inclusion of only nonendogenous content and hence that appropriate causation is necessary for genuine memory does not support that claim, for, despite what Perrin seems to suggest, that evidence does not suggest that "reconstructing an event experienced in the past" is always "cognitively easier than constructing a novel imagined one" (238). It may well *usually* be easier to remember than it is to imagine, but it is certainly not *always* easier to remember than it is to imagine. This is what personal experience suggests. (Compare a long-ago event that one has never or only rarely remembered with an event that one has recently and repeatedly imagined.) And it is what the relevant empirical research shows. When Schacter and Addis say, for example, that "several regions […] were significantly more active for future relative to past events" (781), they refer to average activation: the claim is not that certain regions are *invariably* more active in future thinking than in remembering but only that they *tend* to be more active in future thinking than in remembering.

Perrin does not explicitly say that he takes the evidence to suggest that "reconstructing an event experienced in the past" is *always* "cognitively easier than constructing a novel imagined one" (238), and he might reply here that he need not claim that remembering is always easier than imagining. This would allow him to accommodate the points about personal experience and the empirical research typified by Schacter and Addis (2007) made above. It would, however, also mean that his appeal to that research can no longer be read as an attempt to show that remembering *necessarily* involves transmission. What Perrin needs—simply because what causalism says is that appropriate causation is *necessary* for remembering—is not a difference between *most* cases of future thinking and *most* cases of remembering but rather a difference between *all* cases of future thinking and *all* cases of remembering. Only such a difference can provide support for the claim that remembering is incompatible with the inclusion of only nonendogenous content and hence that appropriate causation is necessary for genuine memory. One might object that Perrin could succeed in putting the ball back in the simulationist's court even while claiming merely that remembering is *usually* easier than imagining. But to so object would be to misunderstand the dialectical situation: Perrin might then succeed in providing evidence that memory often involves appropriate causation, but evidence that

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memory often involves appropriate causation is not evidence that memory necessarily involves appropriate causation.

The second question is raised by Perrin himself. Though he takes the empirical literature on memory as a form of mental time travel to lend "strong support to the idea that as far as remembering is concerned, something transmitted from the past experience is operative in remembering […], while as far as imagining is concerned, no such transmission occurs", he does *not* take it to lend support to the idea that what is transmitted is—as C-CTM would have it—*experiential content*, content (*e.g.*, visual content) that initially belonged to the subject's experiences. Indeed, he argues that an empirical literature that has not so far played a role in the causalist-simulationist debate lends support to the idea that what is transmitted is content or information of a less familiar, nonexperiential sort. In other words, he maintains that there is evidence for a form of transmissionism other than c-transmissionism.

We will see, in the following section, that, if Perrin is right to accuse the anti-necessity argument of overlooking the availability of varieties of transmissionism other than c-transmissionism (2021: 237), the empirical evidence that he cites in support of the variety of transmissionism that he favours ultimately fails to establish that appropriate causation is necessary for genuine memory.

5 – NEW EVIDENCE FOR CAUSALISM?

Perrin formulates the embodied causal theory of memory (E-CTM) as follows (241).

> S has an episodic memory M of a particular past event e iff
>
>> S had an experience E of e in the past on the basis of a procedural pattern p;
>>
>> S now has a representation M of e;
>>
>> M has an appropriate causal connection to E that consists in reenacting it at retrieval on the basis of p.

E-CTM can be restated without loss in a more familiar format:

> S remembers e iff
>
>> S experienced e when it occurred;
>>
>> S now represents e;
>>
>> S's current representation of e is appropriately caused by his previous experience of e, where:
>>
>>> S's current representation of e is appropriately caused by his previous experience of e $=_{df}$ S's current representation of e is caused by a procedural pattern originating in S's previous experience of e.

A *procedural pattern*, Perrin tells us, is to be understood as "motor information … that is not included into the imagistic content [of the memory] but on which S draws to reconstruct that content" (240). E-CTM thus corresponds to a conception of the memory process on which an experience of an event involves the enactment of a particular procedural pattern, a procedural pattern that is then transmitted over time and reenacted at retrieval. Talk of the

transmission of procedural patterns is admittedly not very natural. Perrin makes clear, however, that he means to claim that procedural patterns may be transmitted—encoded, stored, and retrieved—over time, and this claim will not be challenged here.

It is important to note that, while Perrin rejects c-transmissionism, he does not reject transmissionism *tout court*. C-transmissionism, we saw in section 2, is simply a restatement of C-CTM's appropriate causation condition. Analogously, what we can refer to as "e-transmissionism" (for "embodied transmissionism") is simply a restatement of E-CTM's appropriate causation condition. E-transmissionism agrees with c-transmissionism in maintaining that remembering involves the retrieval of stored information originating in the subject's experience of the remembered event. It disagrees with c-transmissionism in maintaining that this information is procedural rather than experiential in character: whereas c-transmissionism says that remembering involves the retrieval of endogenous experiential content, e-transmissionism says that it involves the retrieval of endogenous procedural information. The difference between e-transmissionism and c-transmissionism, and so the difference between E-CTM and C-CTM, thus concerns not *whether* something is necessarily transmitted in remembering but merely *what* it is that is necessarily transmitted in remembering. Indeed, the alert reader will have noticed that E-CTM is identical to C-CTM, the difference between the two theories residing entirely in their respective definitions of appropriate causation: both theories treat remembering as necessarily involving the transmission of information from experience to retrieval, but, whereas C-CTM assumes that the information that is transmitted derives from the content of the experience itself, E-CTM holds that it is or derives from the procedural pattern the enactment of which underwrote the subject's having of that experience. The embodied causalist is thus under the same obligation as the classical causalist to provide empirical evidence in support of the claim that appropriate causation is necessary.

Perrin takes himself to be able to provide such evidence. There is, he writes,

> direct and detailed support for the notion of a particular procedural causal dependence of remembering on past experience. It is part of a wider view on which motor patterns encoded during past experience are reactivated during retrieval […] and it shows that the gaze movements carried out as an event e is experienced and a perceptual experience E occurs are replayed as the memory M of e occurs and are functional to the reconstruction of the imagistic content intrinsic to M. (243)

This is somewhat abstract, but Perrin provides a number of concrete examples, including the following.

> In [Laeng *et al.*'s (2014) experiment], subjects were presented with pictures of animals and were later asked, while looking at an empty grey screen […] to recall the animal in an imagistic way. They found that eye movements at recall substantially overlapped those used to scan the objects in the initial phase of the study, with this overlap being relatively fine-grained since encoding and retrieval were similar with respect not only to the part of the visual space where the gaze dwelled, but also to the most defining and salient features of the particular objects that

> formed the scene […]. Moreover, and most importantly, such an overlap predicted accuracy in memory tasks in that those participants who reenacted eye movements during recall more closely resembling the original movements also showed higher scores in spatial memory tasks. (243)

The idea is thus, to put it crudely, that the subject's eyes move in certain ways as he experiences an event. This sequence of movements—a procedural pattern—is encoded and stored. The stored procedural pattern is later retrieved, enabling the subject to perform the same sequence of movements—in what Perrin refers to as "procedural pattern reenactment"—and thus to "reexperience" the event.

It is important to be clear about *why* Perrin think that the empirical literature on eye movement during recall—he cites a large body of literature in addition to Laeng et al. (2014)—supports the necessity of embodied causation. By Perrin's lights, embodied causation is necessary for remembering because procedural pattern reenactment is necessary for *accuracy* in memory:

> [T]he accuracy of episodic recollections appears to be strongly causally dependent on the re-enactment of the procedural pattern used at encoding. The data comply with two standard requirements for a causal dependence to occur. The previous empirical data allow us to say on the one hand that—all things being equal—if there is re-enactment of the original procedural pattern, then there is accurate memory. It also allows us to say, on the other hand, that if the procedural pattern is not re-enacted […] then the accuracy is diminished. Procedural pattern re-enactment is thus a causal condition for accuracy of memory and […] a necessary one since its absence implies inaccuracy. Since, arguably, accuracy is the distinctive condition for a memory to be successful, then procedural pattern re-enactment is a necessary condition for successful remembering. (244-245)

This argument is somewhat difficult to interpret. The causal theory and the simulation theory are standardly understood as being theories of *genuine* memory rather than *successful* memory, where genuine memory includes both successful memory and "misremembering", which is typified by the DRM effect and is characterized, by causalists (Robins 2016), as occurring when a retrieved memory is inaccurate despite being appropriately caused and, by simulationists (Michaelian 2020), as occurring when a retrieved memory is inaccurate despite being reliably produced. Thus, even if we grant, for the sake of argument, that procedural pattern reenactment is necessary for accurate memory and thus for successful memory, it is unclear why this should imply that it is necessary for genuine memory.

Even if this difficulty can be resolved, moreover, Perrin's argument fails, for two reasons, to demonstrate the necessity of embodied causation. The first reason is recognized by Perrin himself: the experiments that figure in the literature on eye movement during recall concern short timescales, ranging from milliseconds to a week. As Perrin acknowledges, the simulationist might, "object that by 'episodic memory' [he] means memories occurring a much longer lapse of time after the experience they represent—namely, months or years later … . […] STM's anti-necessity objection against [transmissionism] is about … old

episodic memories. If [transmissionism] proves unnecessary for these memories, then STM can conclude that a causal connection is not necessary for episodic memories" (246).

Perrin's response to this objection is twofold. On the one hand, he points out that further research might eventually produce evidence for procedural pattern reenactment in older memories. It might, of course, but—as he freely admits—it might not, and indeed, it would seem, at least at first blush, to be vanishingly unlikely that, as one remembers an event that one experienced many years ago, one again performs the eye movements that one performed when one experienced it.

On the other hand, Perrin points out that whether these eye movements are performed may depend not on the age of the memory as such but, rather, since repeated retrieval tends to increase degree of reconstruction, the number of times it has been retrieved: in the case of a memory that has been repeatedly retrieved and is thus heavily reconstructed, it is less likely that the same eye movements will be performed, even if the memory is recent; in the case of a memory that has not been repeatedly retrieved and is thus lightly reconstructed, it is more likely that the same eye movements will be instantiated, even if the memory is remote. Perrin thus suggests that "a satisfying theory of episodic memory should allow for a distinction between different time courses in the dynamic existence of an episodic memory, with causalism under the form of [E-CTM] being the correct theory regarding relatively lightly constructed episodic memories and STM the correct theory regarding relatively highly constructed episodic memories" (247).

Let us grant, for the sake of argument, that, in the case of heavily-reconstructed memory, it is less likely that the same eye movements will be performed and that, in the case of a lightly-reconstructed memory, it is more likely that the same eye movements will be performed. A view on which E-CTM is correct with respect to lightly-reconstructed memories and STM with respect to heavily-reconstructed memories is, contra Perrin's suggestion, nevertheless not particularly plausible, simply because it entails that episodic memory has an oddly disjunctive character. If the view is right, then, when one initially apparently remembers an event, it must be the case, in order for one's apparent memory to qualify as a genuine memory, that one undergoes procedural pattern reenactment. As one repeatedly remembers the event, however, one eventually—we are not told when—reaches a point at which procedural pattern reenactment is no longer required. At that point, all that is required, in order for one's apparent memory to qualify as a genuine memory, is that it be reliably produced. The view thus makes episodic memory into a deeply disunified category. This does not necessarily mean that the view is wrong—it may ultimately turn out that episodic memory is in fact deeply disunified. But, until we have been given independent reason to suppose that episodic memory is not a unified category, it is preferable to preserve the unity of the category, as simulationism—which, since it may be correct with respect both to lightly-reconstructed and to heavily-reconstructed memories—does and as embodied causalism fails, by Perrin's own admission, to do.

The second reason for which Perrin's argument fails to demonstrate the necessity of embodied causation is not recognized by Perrin but would appear to

be decisive: *procedural pattern reenactment entails neither causation nor appropriate causation*. One can enact a procedural pattern that one previously enacted without enacting it *because* one previously enacted it, and one can enact a procedural pattern because one previously enacted it without enacting it because one *encoded, stored, and retrieved* it. Procedural pattern reenactment, in other words, does not entail e-transmission and thus does not guarantee that E-CTM's appropriate causation condition is satisfied. As we have seen, Perrin argues that "[t]he … empirical data allow us to say on the one hand that—all things being equal—if there is re-enactment of the original procedural pattern, then there is accurate memory. It also allows us to say, on the other hand, that if the procedural pattern is non re-enacted […] then the accuracy is diminished" (244). The problem with this argument is that the causal dependence of (the accuracy of) the retrieved memory on the reenactment of the procedural pattern that was enacted during experience does not imply the (appropriate) causal dependence of (the accuracy of) the retrieved representation on the enactment of that procedural pattern during experience. The empirical literature suggests, if Perrin's reading is on the right track, that, if the retrieved memory is accurate with respect to the corresponding experience, this is because the memory and the experience are underwritten by enactment of the same procedural pattern. But the fact that a memory and an experience are underwritten by enactment of the same procedural pattern does not imply that the memory is caused by the experience or that enactment of the procedural pattern during retrieval is caused by enactment of the procedural pattern during experience. Procedural information is not by definition endogenous.

To see this, it suffices to note that "embodied" versions of Martin and Deutscher's hypnotist and friend cases can easily be described. The basic argument for C-CTM—and, in particular, for the necessity of appropriate causation—is straightforward. Martin and Deutscher (1966) ask us to consider a case in which a subject experiences an event, loses all memory of it, and then comes, under the influence of a hypnotist with no knowledge of the event, to entertain a representation that happens to be accurate with respect to the event in question. This is the *hypnotist* case. They next ask us to consider a case in which a subject experiences an event, recounts it to a friend, loses all memory of it, is told about the event by the friend to whom he recounted it, loses all memory of being told, and then comes, under the influence of what he has been told, to entertain a representation that happens to be accurate with respect to the event in question. This is the *friend* case. Intuitively, the subject remembers in neither case the hypnotist nor the friend case. The unusual feature of the hypnotist case is that there is no causal connection between the subject's current representation of the event and his previous experience of it. We are thus invited to draw the conclusion that it is necessary for remembering that there be a causal connection between the subject's current representation and his previous experience. The unusual feature of the friend case is that, though there is a causal connection between the subject's current representation of the event and his previous experience of it, the connection is not sustained by a memory trace originating in the experience. We are thus invited to draw the conclusion that it is necessary for remembering not just that there be some causal connection or other between the subject's current representation and his previous experience but that there be a causal connection sustained by a memory trace originating in

the experience. Note that this *necessity argument* rests on a straightforward appeal to intuitions.

Now, the classical hypnotist case has the subject experiencing the event, encoding and storing experiential content deriving from his experience, losing that experiential content, coincidentally having that same content implanted in him by a hypnotist, and then retrieving the implanted content. The experiential content of the subject's retrieved memory fails to be endogenous because it does not originate in his experience—c-transmissionism is not satisfied. The embodied hypnotist case has the subject experiencing the event, encoding and storing the procedural pattern that underwrote his experience, losing that procedural pattern, coincidentally having that same procedural pattern implanted in him—perhaps by a neuroscientist, rather than a hypnotist—and then retrieving and enacting the procedural pattern, thereby reexperiencing the event. The procedural information underwriting the subject's retrieved memory fails to be endogenous because it does not originate in his experience—e-transmission is not satisfied.[9]

If the fact that a memory and an experience are underwritten by enactment of the same procedural pattern does not imply that the memory is *caused* by the experience, then, *a fortiori*, it does not imply that the memory is *appropriately* caused by the experience. The embodied hypnotist case is coherent because one can enact a procedural pattern that one previously enacted without enacting it because one previously enacted it. An embodied friend case would be coherent because one can enact a procedural pattern that one previously enacted without enacting it because one encoded, stored, and retrieved it. It would thus be straightforward to describe an embodied friend case, perhaps replacing the friend with a neuroscientist capable not only of implanting but also of copying procedural patterns. In the classical friend case, the experiential content of the subject's retrieved memory fails to be endogenous because, though it does originate in his experience, it does not stay within the subject between the time of experience and the time of retrieval—c-transmissionism is not satisfied. In the embodied friend case, the procedural information underwriting the subject's retrieved memory fails to be endogenous for precisely the same reason: though it does originate in his experience, it does not stay within the subject between the time of experience and the time of retrieval—e-transmissionism is not satisfied.

Now, the embodied causalist might invoke the embodied hypnotist and friend cases in an argument for E-CTM analogous to Martin and Deutscher's argument for C-CTM. To do so would, of course, be to appeal to our intuitions and thus to concede that the relevant empirical literature does not establish the necessity of embodied appropriate causation. The embodied causalist, however, has no obvious alternative: the empirical literature to which Perrin appeals does not establish the necessity of embodied appropriate causation (because scenarios

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[9] The same point—that procedural pattern reenactment does not imply causation by the corresponding experience—could have been made by pointing out that there is nothing to prevent the embodied causalist from providing the same characterization of veridical confabulation that has been provided by causalists of a more classical persuasion (see Michaelian forthcoming): veridical confabulation occurs when a retrieved memory is accurate despite its not being appropriately caused.

like the embodied friend case are possible) or even the necessity of embodied causation (because scenarios like the embodied hypnotist case are possible).

The embodied causalist might object here that the embodied hypnotist and friend cases are merely hypothetical, even fanciful—that, while they are perfectly coherent and thus show that, in principle, procedural pattern reenactment does not imply embodied causation, they do not show that, in practice, procedural pattern reenactment does not imply embodied causation. While the details of these cases are indeed fanciful, however, cases sharing their key features are likely sometimes to occur in practice. The key feature of the hypnotist case is that there is no causal connection between the subject's enactment of a given procedural pattern at a later time and his enactment of that pattern at an earlier time. The key feature of the friend case is that, while there is a causal connection between the subject's enactment of a given procedural pattern at a later time and his enactment of that pattern at an earlier time, that causal connection is not endogenous. Given the similarity between memory and other forms of mental time travel, such as imagining the future, we can assume that any pattern that can be reenacted due to the transmission of procedural information can also be enacted in imagining. Cases having the key features of the hypnotist and friend cases might thus easily occur in practice. One might experience an event, enacting a certain procedural pattern, forget it, and then coincidentally imagine it, again enacting that pattern. In this case, we have procedural pattern reenactment without causation, as in the hypnotist case. One might experience an event, enacting a certain procedural pattern, forget it, and then imagine it, again enacting that pattern, on the basis of information received from an external source and ultimately tracing back to one's experience of the event. In this case, we have procedural pattern reenactment without appropriate causation, as in the friend case. We can thus conclude that, even in practice, procedural pattern reenactment does not imply embodied causation and thus that the evidence cited by Perrin does not demonstrate the necessity of embodied causation.

6 – CONCLUSION

In short, we still have been given no empirical evidence for the necessity of appropriate causation. As a final illustration of this point, note that, while the standard formulation of simulationism assumes that the content of retrieved memories derives from stored content (though not necessarily from stored content originating in experience of the remembered events), Michaelian and Sant'Anna (2021) argue that a version of simulationism that denies that remembering involves the retrieval of stored content is coherent. If this is right, then there is nothing to prevent us from formulating an *embodied simulationism* that stands to the standard simulation theory as Perrin's embodied causalism stands to the classical causal theory. Just as the standard simulation theory and the classical causal theory disagree with respect to the necessity of classical transmission, the embodied simulation theory and the embodied causal theory will disagree with respect to the necessity of embodied transmission. Ultimately, then, the evidence canvassed by Perrin would appear to be orthogonal to the causalist-simulationist debate. We may thus conclude that both Perrin's attack on simulationism and his defence of embodied causalism fail.

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