

Empirical Inconsistencies Defying Simulationism

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Abstract: In our common understanding, remembering and imagining are two different entities. Yet, with brain research progressing, this common understanding of remembering and imagining changes significantly. Simulationists go as far as to claim that remembering and imagining only differ in their temporal orientation but are part of the same system. In what follows, I want to defend our common understanding of how to distinguish between remembering and imagining. With the help of empirical studies, I will defend the view that remembering and imagining are significantly different and not only different in their temporal orientation. I will base my argumentation on empirical studies which are suggestive of simulationism having gotten it wrong. In this paper, I will firstly introduce the two opposing views of simulationism and the causal theory of memory. With the help of empirical studies, I will secondly show that simulationism faces significant evidence of being wrong and thirdly, will suggest that a slightly changed version of the causal theory of memory does a better job in explaining the introduced research results.

Keywords: Causal Theory of Memory; epistemology of memory; memory traces; philosophy of Memory; philosophy of cognitive science; simulationism.

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1. Introduction

When I was a child in Canada, I drove with my family through part of the Northwest Territories. At some point, we stopped near a buffalo roll – an area where buffalo roll in the dirt – and my mother told me to stand in it while she took a picture. Naturally, I was frightened, imagining that a buffalo might appear at any moment, set about rolling, and thereby crush me. Or so I seem to remember. In reality, given my age at the time, and given that my parents repeated the amusing story to me a number of times afterwards, I can't be sure that much – or even any – of the content of my apparent memory of the episode actually originates in my experience, as opposed to the subsequent accounts provided by my parents and my own subsequent imaginings of the episode (Michaelian 2016a, 238).

We sure all have memories like these in which we are not completely sure whether we want to call them memories or whether we would rather claim that we only imagine that we have remembered something as somebody else has told us about our supposed memory so often. Encounters like these, however, beg the question of whether there is a clear difference between remembering and imagining to be had. In our common understanding, we would probably defend the view that there is a clear distinction between the two; we must have experienced what we remember. This view very roughly summarizes the causal theory of memory by Martin and Deutscher (1966). Yet, what needs to be added for Martin and Deutscher's causal theory to be causal is a so-called memory trace. A memory trace provides us with a causal link between an experienced event and the representation of the same event at a later time and enables us to remember in the first place as it is the source for what we retrieve once we try to remember something which has happened in our past (Martin – Deutscher 1966). Yet, by now, there is an opposing view to the causal theory of memory; it is simulationism, introduced by Michaelian (2016a). Michaelian does not see the necessity for a causal link between experienced and remembered event. As long as we are able to represent an experienced event, it does not matter where this representation comes from. It might not come from memory directly but might be simulated as well and still be a memory. This

is why Michaelian suggests that imagining the past is remembering and that remembering and imagining thus do not differ in kind. If imagining the past is remembering, we do not necessarily have to have experienced the event we now imagine.

In this paper, I want to argue against simulationism on empirical grounds. In what follows, I will show that simulationism contrasts with empirical studies. I will firstly introduce Martin and Deutscher's theory of memory traces and Michaelian's theory of simulationism. Secondly, I will show studies which suggest that there is a difference between remembering and imagining and thirdly, will argue for these studies showing that this difference is big enough to distinguish between remembering and imagining in kind and not just in degree. Fourthly, I will suggest what alternatives we have if simulationism should be wrong. I will argue that we should consider a version of the causal theory of memory to explain the difference between remembering and imagining. Yet, I suggest that the distinction between remembering and imagining should not be made by the mere presence of a memory trace but by whether a memory trace is solely operative in representing an experienced event.

2. Causal theory of memory and simulationism

As it will be central to my argument in this paper, let me introduce the term 'episodic memory' first. Episodic memory refers, roughly, to the form of memory responsible for allowing us to revisit specific episodes or events from the personal past. It is contrasted with semantic memory, which allows us to recall facts without necessarily giving us access to the episodes in which they were learned' (Michaelian 2016a, 5). Moreover, episodic memory, in contrast to semantic memory, does not only give us propositional contents such as 'A dinosaur is a fossil reptile of the Mesozoic era', which can simply be evaluated as true or false, but, because episodic memory gives us richer representations, it can provide us with more or less accurate representations of what we have experienced. For example, when I remember my encounter with the statue of an avimimus at a dinosaur park, I might remember what its statue looked like but might have forgotten where exactly it was located (was it next to the T-rex or closer to the

Brachiosaurus?), I might remember what it felt like to see this huge creature and also how it felt like when I touched it. This is memories of events and us experiencing them and they thus belong to episodic memory. Yet, if we were to put them into a more factual, propositional form such as: ‘Touching the statue of an avimimus feels funny is it is so cold’ or ‘The avimimus statue was located next to the T-rex’, we have semantic memories.

In the case of the buffalo roll, our narrator has a semantic memory if they just recall the proposition ‘I was afraid a buffalo would come by and crush me’ and an episodic memory if they represent what has happened to them in the specific situation of standing in the buffalo roll such as their feeling of being frightened, how the buffalo roll looked like, what clothes their parents wore etc.. While an episodic memory can thus come with different degrees of accuracy, what both forms of memory have in common, at least in our common understanding of the word remembering, is that the memory of our narrator in the buffalo roll must originate in their own experience. If they just represent having been afraid standing in the buffalo roll based on the testimony of their parents, they do not remember but imagine having been afraid, since what they represent is not caused by what they have experienced but by their parents’ testimony.

This common understanding of remembering is captured by Martin and Deutscher’s (1966) causal theory of memory. In their understanding of how memory works, we remember once we have a so-called memory trace present. A memory trace is a state or set of states which was produced by a past experience and forms a structural analogue of the experienced event within our memory. It works similar to the grooves in a gramophone record. While the number of wiggles per unit length in a groove determine the pitch of the played music, an experienced event would analogously leave traces in our memory which make it eventually possible to recall an experienced event and represent what has happened at a later time (Martin & Deutscher 1966, 191). The causal connection between experienced and recalled event a memory trace provides is, however, neither a necessary nor a sufficient but an operative condition¹. A condition is operative if it produces another

¹ A memory trace may still be a necessary and even a sufficient condition for remembering but what is of importance in their paper is the operative condition (Martin & Deutscher 1966, 179).

condition but, in contrast to necessary cases, the caused condition could also have been caused by another condition (Martin & Deutscher 1966, 179). For instance, if I spill a drink, I am the one who has caused the table to be wet. However, my spilling a drink is not necessary for the table to be wet. The drink might as well have been spilled by someone else or the table could have gotten wet for other reasons. While me spilling the drink is not a necessary condition for the table being wet, me spilling the drink is an operative condition as, in this situation, it was me who has spilled the drink and caused the table to be wet. In the case of memory, a memory trace is only an operative and not a necessary condition because the representation of what we have experienced is not necessarily caused by a memory trace. In principle, there could also be other causes for why we represent something, for instance, having spilled a drink. If we represent having spilled a drink, we could be caused by our friend to represent that we have spilled a drink. In this case, we have experienced having spilled a drink and are able to represent that we did so. The operative condition in this case is the testimony of our friend. However, Martin and Deutscher (1966) explain that we do not remember having spilled a drink if the testimony of our friend is the operative condition. In order to remember, it is the experience of having spilled the drink which causes us to represent that we spilled the drink. The testimony of our friend won't do.²

The connection between the experience of having spilled a drink and representing us having spilled a drink is a memory trace. A memory trace captures the demand of our common understanding of what remembering is. We need to have experienced an event ourselves and, once we recall the experienced event, this representation needs to be caused by us having experienced that event. A memory trace ensures that this is the case. If there is a memory trace present, we must have experienced an event ourselves and must be able to represent what has happened based on that memory trace, based on the causal connection between experienced event and the representation of that experienced event at a later time. In case of our

² As I wanted to explain the operative condition in this paragraph, I have left out the accuracy condition. Yet, keep in mind, that the accuracy condition also needs to be present if we want to be said to remember according to Martin and Deutscher (1966).

narrator's parents' testimony, there is no memory trace present if they did not experience the event of the buffalo roll themselves but only heard about what they have experienced from their parents. Without a memory trace, however, there is no remembering. In case of our narrator's parents' testimony, the narrator can imagine having been afraid of the buffalos crushing them but cannot remember.^{3,4,5}

However, even though the causal theory of memory seems to capture our common understanding of remembering, the causal theory of memory, according to Michaelian (2016a, 98f.), does not stand up to recent results

³ One could object here and ask about cases in which our friend's testimony triggers the activation of a memory trace. As long as the memory trace itself is the operative condition for us remembering, though, we can be said to remember. If our friend's testimony alone triggered the representation of us having spilled a drink, however, the testimony of our friend would be the operative condition and, according to Martin and Deutscher (1966, 179), we could not be said to remember.

⁴ Another objection to Martin and Deutscher's operative condition could be made by asking the question of what if another memory trace than the one formed during the experienced event is responsible for us being able to retrieve an experienced event. If we follow Martin and Deutscher here, the answer is clear: no causal connection between remembered and experienced event means no remembering.

⁵ Martin and Deutscher also introduce the term of remembering-how. Remembering-how is not remembering a specific event but being able to engage in a specific action because we have learnt how to do this action in the past. We may, for instance, remember how to swim but not remember at which specific time and location we learnt how to swim. Nevertheless, our lack of remembering that specific experience in our past does not stop us from being able to swim if we have learnt how to swim in the past (Martin & Deutscher, 1966, 161). I will leave out further considerations regarding remembering-how in this paper as remembering how to do a certain thing usually requires more than one specific event. For instance, when you learnt how to swim, you might have not gotten it on the first stroke but had to try for a few minutes first to stay afloat. Step by step and maybe even on multiple occasions, you have gotten better at swimming and do not just stay afloat but are able to swim quickly from one end of the lake to the other. In this sense, remembering-how might also use memory traces but usually multiple ones at the same time and with different content than in episodic memory as we do not need to remember in which exact way we have learnt to swim in order to be able to swim but only how we have done it (and that can even be done in a subconscious way).

from brain research. Findings suggest that remembering and imagining are linked to a broader range of forms of episodic imagination (Buckner – Carroll 2007; Hassabis & Kumaran & Maguire 2007a; Hassabis & Maguire 2007b, 2009; Schacter & Addis 2007a, 2007b; Schacter et al. 2007c). Episodic imagination could, for example, be imagining the future, the counterfactual future, the present or the counterfactual present, the past or the counterfactual past. Even phenomena such as mind wandering or dreaming may count as episodic imagination. For instance, when we imagine walking around in a familiar city, we also draw on remembered events as our building blocks to represent us walking around in a familiar city. Even when we are just imagining, we use remembered events in order to be able to imagine. Moreover, when we remember, we likewise use our imagination in order to achieve representing an event we have experienced. This motivates Michaelian to introduce simulationism. According to simulationism, episodic imagination includes both remembering and imagining and is produced by a general episodic construction system. This episodic construction system, by producing different forms of episodic information, flexibly transforms and recombines stored information from a variety of sources in order to produce representations of different episodes. Remembering, as it is part of the episodic construction system, is thus a specific form of imagination.

Remembering differs from other forms of episodic imagination when it comes to the target of its representation. In case of remembering, the episodic construction system must aim at imagining an episode from the subject's personal past. It is important to highlight that it is not the subject's target which is of importance here but the aim of the episodic construction system as a person might misclassify their own intentions. They might for instance, think that they are trying to imagine the past while the episodic construction system generates a representation of the future. Thus, it is the 'intention' of the episodic construction system to imagine the past which distinguishes remembering from other forms of imagination. The only difference between remembering the past and imagining the future lies in the target of the episodic construction system and remembering is thus defined as imagining the past. Therefore, the difference between remembering and imagining is a matter of degree (in their target of representation) but not

in kind as both are forms of episodic imagination and these forms of imagination are part of the same mechanism (Michaelian 2016c).

Furthermore, if remembering is one form of episodic imagination, Michaelian (2016a, 104) explains, then our common understanding of remembering does not necessarily apply anymore. While we would usually assume that we need to at least draw on some information originating in the experienced event of our personal past in order to remember and would usually assume that we thus need to have something like a memory trace present in order to ensure that we actually remember, a memory trace becomes superfluous under simulationism (Michaelian 2022, 3). We may still have memory traces, even in the case of imagining in order to draw information from them but they are not a necessary condition for remembering or imagining. As long as we are able to imagine the personal past with the intention of our episodic construction system to imagine the personal past, it does not matter whether we draw on information originating in an experience of the experienced episode of our personal past, but it is only of importance whether we are able to imagine our personal past with our episodic construction system. The information we draw on may originate in an experience of the specific episode but does not necessarily have to. If we are able to imagine the personal past with the intention to imagine the personal past but draw on other information originating in other events of our past, this process is still to be seen as remembering as remembering is to imagine the personal past according to Michaelian and does not come with the requirement to be causally rooted in an event we have actually experienced (Michaelian 2016a.).

3. Empirical evidence defying simulationism

Michaelian claims that remembering and imagining being linked to a broader episodic imagination system implies that they only differ in degree or namely only differ in the intention of the episodic construction system (2016a, 98f.). If remembering and imagining both use the same mechanism and only the outcome of the mechanism is slightly different, we could argue for a difference in degree only. Yet, if remembering and imagining were to differ in degree only, they would need to function equally well. In the

following, I will show that they do not. There are cases in which our ability to imagine remains unimpaired while we are not able to remember. This implies that there is not only a gradual difference between the both of them but a difference in kind. While my main argument will rely on empirical studies which support my claim that the difference between remembering and imagining cannot only be gradual because remembering and imagining do not function equally well, I will also shortly introduce a theory of how this difference in quality could be explained by different brain mechanisms. While I will introduce this possible explanation, the truth of it is not necessary for my argument to be valid. What is necessary is that remembering and imagining do not always function equally well.

In what follows, I will firstly show how a paper Michaelian cites to show that remembering and imagining are the same in kind is also suggestive of there being significant differences between the both of them. Moreover, Michaelian also takes cases of people with amnesia to be suggestive of remembering and imagining being of the same kind. I will secondly outline his claim and subsequently show that research with amnesic people can also be found indicative of remembering and imagining coming apart in kind. Thirdly, I will add a study which suggests that the ability to remember and to imagine comes apart in people without any memory impairment as well.

Michaelian (2016a) suggests that empirical research is indicative of the same brain areas, namely the episodic construction system, being used for remembering and imagining and proposes to see remembering and imagining to be of the same kind due to these empirical results. While it might already be a questionable attempt to decide whether something differs in degree or kind on the basis of neuronal connections, I will take his suggestion at face value here and show how I could oppose his claim. Michaelian (2016a, 98ff.) cites a paper by Schacter and Addis (2007a) to support his claim that remembering and imagining both have the same underlying structure of the episodic construction system. However, while the given paper supports this claim by explaining that there is a considerable overlap of neural and psychological processes involved in imagining and remembering, it also points out significant differences between both. When it comes to recognizing what we have actually experienced and thinking to recognize

something we did not actually experience, different brain activity can be found (Schacter & Addis 2007a, 777) depending on whether we have experienced something or not. Schacter and Addis (2007a, 779) also explain that D'Argembeau and van der Linden found that imagined future events were less vivid when it came to sensory and contextual details than remembered past events. More importantly, though, is their finding of a study by Okuda et al. (1998) which has found that, in contrast to cases of recalling the past, there was a strong positive correlation between imagining the future and right frontopolar activity. Moreover, when activity between constructing past and future events was measured, several brain regions were significantly more active when it came to imagining the future than when it came to remembering the past. These brain areas included the bilateral premotor cortex and left precuneus (Schacter et al. 2007a, 780f.). The introduced counterevidence already provides some room for criticism on Michaelian's theory. However, apart from an explanation of how remembering and imagining work neurally, there is some counterevidence to simulationism which bites harder.

Michaelian (2016a, 98) proposes additional evidence for remembering and imagining being of the same kind by explaining that Tulving (1985) had already tentatively linked the ability to imagine the future to the ability to remember the past because amnesic patients had been found to be unable to remember past episodes and were also impaired in imagining future episodes. Moreover, further evidence can be found for remembering the personal past and imagining the personal future at least being correlated. People with damage to their hippocampus have been found to have an episodic memory impairment and at the same time an impaired ability to imagine the personal future (Tulving 1985; Klein et al. 2002; Rosenbaum et al. 2005; see Addis et al. 2007 for neuroimaging evidence; Kwan et al. 2010, Juske-naite et al. 2014, De Luca et al. 2017). The conclusion that these results suggest that remembering and imagining are of the same kind seems reasonable in this context and could well be explained by remembering and imagining both relying on the episodic construction system. Yet, if remembering and imagining only differ in degree, they have to function equally well. While this is the case in the by Michaelian introduced studies, there are also multiple cases in which imagining seems to be unimpaired or only

mildly impaired while the ability to remember is severely impaired. I will introduce the relevant studies in the following.

Studies (Allen, 2018; Andelman, Hoofien, Goldberg, Aizenstein & Neufeld, 2010; Klein, Loftus & Kihlstrom, 2002; Tulving, 1985; Mullally, S. L. & Maguire, E. A., 2014) suggest that patients with amnesia can imagine events which have happened to other people without severe limitations compared to healthy control subjects while their ability to remember their past is severely impaired. Moreover, people with memory impairments were still found to be able to imagine future experiences and people's possible pasts, people's real pasts and presents in a slightly impoverished fashion while their ability to remember their own past was highly impaired. Juskenaitė et al. (2014), for instance, have examined people with transient global amnesia⁶. They found that these people were able to imagine personal future events nearly as well as healthy control participants if there was a short description of common scenarios present. However, they struggled with recalling personal past events when they were asked to do so. They produced significantly fewer past events than control groups and the events were scant and contained less details. Cooper, Vargha-Khadem, Gadian, and Maguire (2011), have reported that 21 children with developmental amnesia⁷ displayed an unimpaired ability to imagine new events when a short description of possible events such as "Imagine you are by a campfire in the mountains" was given to them. The imagined events were similar to events children have already experienced multiple times (such as sitting by a campfire). At the same time, the same people could not remember their own personal past or only to a very limited extent. Maguire, Vargha-Khadem

⁶ Transient global amnesia (TGA) is a condition characterized by sudden onset of memory loss and confusion. During an episode of TGA, a person is not able to make new memories. The person may be disoriented in regard to time and place, but can remember who they are and can recognize family members. TGA typically lasts for several hours, but can last up to ten hours. Since no memories are made during a TGA episode, the person will never remember what happened during this period, but all other memory is usually intact. Most people have only one episode of TGA during their lifetime. The underlying cause of TGA is unclear (Genetic and Rare Diseases Information Center 2021).

⁷ Developmental amnesia is amnesia with an early onset. Namely, when neural plasticity is at its peak in children (Vargha-Khadem et al. 2003).

and Hassabis (2010) have shown that another patient's ability to imagine new events which they had experienced multiple times, when supplied with a short description of these experienced events, was intact but not their ability to imagine old, experienced events. Hurley, Maguire, and Vargha-Khadem (2011) have reported similar results on the same task for a person suffering from developmental amnesia (Kwan, Carson, Addis & Rosenbaum, 2010). Rosenbaum et al. (2009) have examined a patient with severe anterograde and retrograde amnesia. Retrograde amnesia is the inability to remember events before the onset of amnesia while anterograde amnesia is the inability to remember events after the onset of amnesia. Retrograde and anterograde amnesia can also appear simultaneously (Gilboa et al. 2006). The person Rosenbaum et al. (2009) had examined was able to reconstruct semantic information of their past and future and was not only able to come up with narratives but was also able to distinguish between non-personal semantic narratives and personal ones in the settings of the experiment even though they were not able to in episodic narratives. They were able to generate fictional events (such as, what people will do at a birthday party) and to recall and recognize details of well-known fairy tales and bible stories to a lesser extent than people without this impairment but still too a high degree. Their recall was more skeletal and gist-like than in healthy control participants, but the patient was able to come up with a consistent story. Yet, the same patient was also described as follows: he has a high number of semantic but a low number of episodic or autobiographic memories. His semantic and procedural memory seem to be unimpaired, but his episodic memory is highly impaired. He cannot experience extended subjective time. He feels like he has a personal identity, but this does not extend to past or future. He seems to be living in a permanent present (Tulving 1985). Cermak and O'Connor (1983) report on a person with severe anterograde and retrograde amnesia caused by a case of encephalitis. Despite their severe case of amnesia, they could still encode information at a semantic level and were able to rely on semantic information when it came to generating events of what could have happened in their past. Yet, they were not able to recall episodes of their lives, neither personal nor public ones. O'Connor et al. (1992) also report that a young amnesic person they had worked with was still able to recall factual, semantic information of the past with some

impairments but had severe problems recalling personal episodic events. In this severe case, the person was not able to recall any events before the onset of their illness including their high school years and their early childhood or the fact that their parents had been divorced three years before the onset of their amnesia, names of their childhood friends or high school graduation.

The introduced studies suggests that people with amnesia can still imagine non-personal episodes such as the past, the future, the possible past and the possible future and also their own potential future if they are provided with a short description about what they had already experienced in their past. However, at the same time, they are not able to reconstruct their own personal actual past to an equal qualitative and quantitative level. Their ability to imagine and their ability to remember comes apart. If remembering and imagining were of the same kind, this should not be the case as an impairment at one level should have the same effects on all kinds of episodic imagination. Therefore, I propose that remembering and imagining are different in kind.⁸

Moreover, evidence for a significant difference between remembering and imagining cannot only be found in people with amnesia but also in people without any neural impairments. The first, and at that time only, lifespan study about episodic and semantic past, present and future autobiographic memory of all age groups from childhood to older adulthood suggests that remembering and imagining could have a fundamental different basis. This claim is based on the finding that imagining the personal future remains

⁸ Some of the introduced studies seem to suggest that remembering and imagining may not be so different after all as imagining the past and remembering seem to be at an equal level of impairment in amnesic people. Firstly, I want to remark that it is hard to distinguish between whether a person imagines or remembers the past in an empirical experiment. Yet, even if I should grant the point of remembering and imagining the past being equally impaired here, the studies still support my distinction in a quantitative fashion as people with amnesia can still imagine non-personal episodes such as the past, the future, the possible past and the possible future and also their own potential future if they are provided with a short description about what they had already experienced in their past, but, at the same time, are not able to reconstruct their own personal actual past to an equal qualitative and quantitative level.

equally difficult for all age groups even though their episodic memory is at different levels of quality depending on people's age. 6-8-year-old children were found to be truly unable to imagine or remember personal events. Because of the parallel inability to remember and imagine, one could initially assume that remembering and imagining are part of the same mechanism (Abram et al. 2014). However, Naito and Suzuki's (2011) study suggest that future episodic autobiographic memory abilities develop after the age of five while the ability to episodically remember is developed to a fuller extent at the age of four already. Up until young adulthood, the ability to episodically remember increases while a general decline in this ability can be found after young adulthood. The ability to episodically remember can be illustrated in an upside-down turned U-formed graph. While the lowest points would be early childhood and older adulthood, the highest point would be young adulthood. With decreasing episodic remembering ability, semantic remembering fills in and is more commonly used in older adults than in younger ones⁹. As there are different abilities to episodically remember due to a U-shaped development in people, one should assume that the ability to episodically imagine the future would also decline in age and grow from childhood up until young adulthood. However, except for 6–8-year-old children, in which both abilities were not clearly given yet, the ability to episodically imagine the future has been found to remain at an equal level independent of age groups (Abram et al. 2014).¹⁰

This study shows a difference between remembering and imagining. While imagining seems to stay at an equal level of ability independent of

⁹ Addis, Schacter and Roberts (2011) have also proposed that imagining and remembering underlie the same constraints when it comes to episodic and semantic memory. Older adults have been found to not only draw from more semantic information when it comes to remembering but also when it comes to imagining. This, however, is not counterevidence to my claim as the ability to imagine, according to Abram et al., 2014, stays at an equal level while the ability to remember declines. For my argument, it does not matter how imagining or remembering is achieved but whether it is at the same quantitative level.

¹⁰ There are studies which suggest that the ability to imagine one's own future also declines with age (i.e. Than 2008). Yet, the given studies mainly describe a switch from episodic to semantic information, not, however, a decline in the ability to imagine.

age, the ability to remember is fluctuating. Yet, if remembering and imagining were of the same kind, this should not be the case. Once people have problems to access their personal past, they should also have problems in imagining their personal future and an increased ability in accessing one's memory should cause people to be able to imagine their personal future better than with less ability to access their memory.

The cited studies suggest that there is a difference in the ability to remember one's past and to imagine in people with amnesia but also in people with non-impaired memory. If remembering and imagining were of the same kind, this should not be the case. If they were of the same kind, they should be equally impaired. I also assume that this difference cannot be explained by a difference in intention in the episodic construction system. Having a different intention should not cause a gap in what we are able to remember and imagine. Therefore, I suggest that they come apart in more than just the intention of the episodic construction system. Remembering and imagining are of different kind.

4. A Causal theory of memory

In the last chapter, I have introduced empirical studies which defy the claim of simulationism that remembering and imagining are of the same kind. While they both may rely on the same system, they seem to need additional processes to actually constitute remembering or imagining. Therefore, I claim that simulationism cannot be right. Yet, it's opposing view of the causal theory of memory also cannot explain the difference between remembering and imagining. The original distinction consisted in remembering needing a memory trace. However, in order to imagine, we also need to imagine from something and this something we imagine from is usually also something we have experienced. Thus, remembering and imagining are both in need of memory traces. In what follows, I will suggest that a slightly changed version of the causal theory of memory enables us to make a distinction between remembering and imagining which is consistent with the introduced research data. I will introduce the slightly changed version first and will subsequently explain how it helps us in making a distinction between remembering and imagining.

Martin and Deutscher did not describe how a memory trace would look like from a neurological standpoint of view. However, there is empirical evidence for memory traces in the form of brain reactivation. According to the so-called sensory reactivation theory, there is reactivation of the same brain areas present which were active while experienced events got encoded (Rugg et al. 2008). Additionally, the sensory reactivation theory can also be supported by the fact that memory does not come with one dedicated encoding circuit. Depending on which information gets encoded, different brain areas are active (Rugg et al. 2008). Therefore, we should have reactivation of the same brain areas which were active in encoding during recall. This seems to be the case. Addis et al (2009) explain that neuroimaging studies of memory for previously studied pictures have revealed reactivation during retrieval of some of the same visual processing regions that were active during encoding. Woodruff et al. (2005) have found a dissociation in activation for brain areas when it came to recall of pictures and words. So, a different brain area was active when a word was recalled than when a picture was recalled. Kahn et al. (2004) found that tasks which require either visual imagery or phonological processing elicited a greater response in their respective brain areas during retrieval. So, words from the phonological condition elicited greater activity in areas responsible for phonological processing while words from visual imagery elicited greater activity in its respective brain areas during recall. Rugg et al. (2008) found that people who were asked to study words in four different locations and colors were found to have higher brain activity in, among other regions, their retrosplenial cortex if they correctly reported the location of the word and higher activity in their posterior inferior temporal cortex if they correctly recalled the color of the word. The retrosplenial cortex has been previously found to be active in the process of encoding information when it came to location and the posterior inferior temporal cortex when it came to encoding information about color (Chao and Martin 1999; Kellenbach et al. 2001; Mayes et al. 2004; Frings et al. 2006). The sensory reactivation theory also leaves room for the possibility that we do not recall something we have experienced one to one but only with deviations. The sensory reactivation theory does not demand a perfect overlap between an originally encoded event and brain activity during retrieval. Johnson and Rugg (2007), for instance, report a

limited overlap between brain activity in encoded information and retrieved information. Yet, Rugg et al. (2008) suggest that even activity which only partially overlaps with formerly encoded information may cause the reactivation of the whole former representation. This can be explained by memories usually being distorted and being invariably partial records of an originally experienced event (Bartlett 1932; Loftus & Palmer 1974, Schacter 2002). With the sensory reactivation theory, we have a possible scientific explanation of what memory traces may look like. In the following, I will also explain how this theory helps the causal theory of memory to make a distinction between remembering and imagining.

According to Martin and Deutscher (1966), we remember if a memory trace is operative in recalling an experienced event. If a memory trace is not operative in recalling an experienced even, we do not remember. Applied to the sensory reactivation theory, this would mean that we remember if there is the same reactivation of formerly active brain areas present in recall than was present while we have experienced the event we recall. However, the mere presence of a memory trace is also not sufficient to distinguish between remembering and imagining because imagining could in principle also come with a memory trace. After all, we need to have some input to imagine even a counterfactual event from and this might as well be done with the help of a memory trace. According to Michaelian (2016a, 99 ff.), this way of reasoning has led brain research to the suggestion that remembering and imagining are linked to a broader range of forms of episodic imagination and which had led him to propose the gradual distinction between remembering and imagining. The possibility that we use memory traces in imagining cannot be excluded and I will not argue against it. Memory traces may as well be active in the case of imagination. I claim, that remembering and imagination, cannot be distinguished by the presence of a memory trace but by whether a memory trace is solely operative in representing an experienced event. Schacter and Addis (2007a) suggest that remembering and imagining both need information from memory. However, only imagination requires flexible recombination of these events in order to be able to recombine the given events into a new event. Remembering, by just representing the past, does not need recombination. Thus, even if there are memory traces involved in representing an event, it is not the sole

responsibility of the memory trace to produce an imagination. In order to imagine, we do not only need memory traces but further processes on top of memory traces. In remembering, however, these processes of recombination are not needed. It suffices if the memory trace is operative in producing a representation of a past event for us to remember. Therefore, I claim that the distinction between remembering and imagining can be drawn by answering the question of whether a memory trace was solely operative in producing a representation. If a memory trace was solely operative in producing a representation, we remember. If we need more than the operative presence of a memory trace, we imagine. This claim can also be supported by Addis et al. (2009). They suggest that remembering and imagining both need to draw information from memory but that they are divided into two subsystems. Remembering past events is associated with greater recruitment of a remembering subsystem than is imagining events. This subsystem included posterior visual cortices, such as fusiform, lingual and occipital gyri and cuneus, in addition to regions previously associated with remembering past events (i.e., medial prefrontal, hippocampus and parahippocampal gyrus) while an imagining subsystem network included extensive aspects of bilateral medial prefrontal cortex, inferior frontal gyrus, medial temporal lobe, polar and posterior temporal cortex, medial parietal cortex and cerebellum.

In this paper, I have argued against the claim of simulationism that remembering and imagining are of the same kind. I have cited studies that suggest that simulationism is defeated. Moreover, I have also given a possible explanation of how we can actually make a distinction between remembering and imagining. Both remain separate entities

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