Title: Causally defective remembering: A study on the folk concept of memory

Abstract: The standard argument for the causal theory of memory relies on intuitions about scenarios in which subjects accurately represent events from their pasts but do so in a "causally defective" manner. Examples include representations based on suggestion and representations based on relearned information. According to causalists, these scenarios, intuitively, are not cases of remembering. This paper applies the methods of experimental philosophy to determine whether laypeople share causalist intuitions. We find that, in scenarios in which all of the causal theory's requirements for remembering are fulfilled and in scenarios in which none of these requirements are fulfilled, laypeople's intuitions align with the causal theory's verdicts: they clearly ascribe remembering in the former scenarios and clearly deny remembering in the latter scenarios. In causally defective scenarios—scenarios in which some but not all of the requirements of the causal theory are fulfilled—a more complex pattern of responses is observed, with some participants ascribing remembering even in cases that do not satisfy causalist requirements. In particular, while many participants deny that remembering occurs in relearning, many do the opposite. These results suggest that folk ascriptions of remembering only partly align with the causal theory of memory.

Keywords: memory; causal theory of memory; relearning; appropriate causation; deviant causation.

1 Introduction

According to the causal theory of memory (CTM), a subject remembers an event if, and only if, there is an appropriate causal connection between the subject's experience of the event and his apparent recollection of it, where an appropriate causal connection is one that is sustained by a memory trace originating in the subject's experience of the event. CTM is the most influential theory of memory for at least two reasons. On the one hand, CTM does justice to the idea that, as Michaelian and Robins put it, "[i]t is natural to think of remembering in terms of causation: I can recall a recent dinner with a friend *because* I experienced that dinner" (Michaelian and Robins 2018: 13, emphasis in the original). On the other hand, CTM enjoys an apparently solid intuitive status. CTM is, as Perrin puts it, "(…) clearly in line with many of our intuitions about memory, and allows us to rule out a number of cases to which these intuitions are reluctant" (2022: 89-90).[1] The standard argument for CTM relies on intuitions about scenarios in which subjects accurately represent events from their pasts but do so in a "causally defective" manner. Examples include representations based on suggestion and representations based on relearned information. According to causalists, these scenarios, intuitively, are not cases of remembering.

This paper applies the methods of experimental philosophy to determine whether laypeople share causalist intuitions. We find that, in scenarios in which all of the causal theory's requirements for remembering are fulfilled and in scenarios in which none of these requirements are fulfilled, laypeople's intuitions align with the causal theory's verdicts: they clearly ascribe remembering in the former scenarios and clearly deny remembering in the latter scenarios. In causally defective scenarios—scenarios in which some but not all of the requirements of the causal theory are fulfilled—a more complex pattern of responses is

[1] This is our translation. The original passage in French is: "Elle [CTM] s'accorde nettement avec nombre de nos intuitions relatives à la mémoire et permet d'écarter un certain nombre de cas auxquels ces intuitions sont réticentes".

observed, with some participants ascribing remembering even in cases that do not satisfy causalist requirements. In particular, while some participants deny that remembering occurs in relearning, many do the opposite. These results suggest that folk ascriptions of remembering only partly align with the causal theory of memory.

The structure of the paper is as follows. The remainder of this section presents the alleged intuitive appeal of CTM (section 1.1) and introduces our hypotheses (section 1.2). Section 2 describes the materials and results of the three studies that we conducted in order to test our hypotheses. Section 3 provides a general discussion of the results and points out some limitations of our studies. Section 4 concludes.

The main hypothesis that we tested here was that, if the intuitive status enjoyed by CTM is as solid as it is sometimes presented in the literature, subjects would align their ascriptions of remembering with those of the advocates of CTM. Since our findings suggest that this does not reliably occur in causally defective cases, the intuitive status so far enjoyed by CTM requires closer examination. While it might still be natural to think of remembering in terms of causation, it is not obvious that the folk concept of memory includes the intuitions that motivate CTM.[2] After all, our participants' responses do not clearly rule out the causally defective cases to which their intuitions are supposed to be reluctant.

1.1 The causal theory's intuitive appeal

The classical formulation of CTM was provided by Martin and Deutscher (1966) and continues to be extremely influential in philosophy.[3] Part of CTM's appeal is due to its

[2] See Simons and Chabris (2011) and Finley et al. (2018) for discussions on the folk concept of memory.
[3] Numerous versions of CTM have been proposed in recent years. Neoclassical versions endorse the key claims of Martin and Deutscher's theory but modify their view of memory traces to some extent (Bernecker 2008, 2010). Distributed (Sutton 1998, 2010), procedural (Perrin 2018), minimalist (Werning 2020), and embodied (Perrin 2021) versions modify CTM's conception of memory traces more substantially. Constructive versions attempt to bring CTM into line with empirical findings on the (re)constructive nature of remembering (Michaelian 2011; Robins 2016; Sutton and O'Brien 2023). And hybrid versions accept the necessity of appropriate causation for remembering but deny its sufficiency, suggesting additional necessary conditions for remembering inspired by a range of philosophical and empirical considerations (Debus 2010; Dokic 2014; Klein 2015). Even Fernández' (2019) functionalist theory, which denies both the necessity and the sufficiency of appropriate causation for remembering, remains close in spirit to CTM. Moreover, De Brigard's (2024a)

purported intuitive understanding of remembering. Indeed, the main argument for the theory relies on intuitions about hypothetical scenarios, intuitions that will, causalists seem to assume, be widely shared. Despite the widespread appeal of the theory among philosophers of memory, it is, however, far from obvious that the relevant intuitions are widely shared among nonphilosophers.

In recent years, philosophy of memory has witnessed a naturalist turn. Many contemporary versions of CTM are primarily concerned with integrating findings from the sciences of memory rather than with grounding the theory in intuition. Martin and Deutscher's classical formulation remains, however, foundational to philosophical discussions, and this formulation was explicitly built on intuitions elicited by thought experiments. They consider scenarios in which a subject's representation of the past seemed intuitively not to count as remembering, thereby revealing the necessary conditions for genuine memory. As Werning maintains, CTM's "intuitive support stems from a number of thought experiments" (2020: 310; cf. Perrin 2022). The continued appeal to intuitive support raises a methodological question about the role of intuition in philosophical theorizing about memory. In this context, it is important to distinguish, as Machery (2017) suggests, between projects that aim to identify what memory necessarily is and empirical projects that clarify how particular communities actually conceptualize memory. Our project is of the latter sort. We do not assume that folk intuitions provide evidence for the nature of memory itself, but rather investigate an empirical claim implicit in the philosophical literature, namely, that the causalist verdict on causally defective scenarios reflects widely shared intuitions. If this empirical claim is correct, then CTM may capture a folk understanding of memory (see, e.g.,

simulationism tries to make compatible simulationism and causal intuitions. Of the theories of memory currently on offer, only Michaelian's (2016) simulation theory explicitly contradicts CTM's main tenets. See Michaelian and Robins (2018), who propose the taxonomy of theories on which we rely here.

Mahr et al. 2025); if not, it may instead reflect a more specialized philosophical conception. Our findings suggest the latter.[4]

The idea that remembering necessarily involves an appropriate causal connection is motivated by intuitions about causally defective scenarios involving fortuitous representing, reminding, and relearning. The following scenario—based on the "hypnotist" case described by Martin and Deutscher—is an illustrative "fortuitous representing" scenario.

> **Fortuitous representing scenario:** Charlie witnesses a car accident, but then entirely forgets it. Some days later, Charlie attends a show in which a hypnotist, who has no knowledge of the accident, leads him to believe that he witnessed a car accident. By sheer coincidence, the details of that accident are accurate with respect to the witnessed accident. Subsequently, Charlie forgets being hypnotized and entertains a representation of an accident based on the hypnotist's suggestion, claiming to remember it.

According to causalists, remembering an experienced event requires at least two things: a *past experience* of the event and an *accurate present representation* of the event. But, they argue, it requires something else as well: although Charlie experienced the accident and entertains an accurate representation, it is clear that he is not remembering. Since there is no causal connection between Charlie's representation of the accident and his experience of it, causalists take the scenario to suggest that, in order for a subject to count as remembering an event, his past experience of it must have *causal influence* on his present representation of it. As Martin and Deutscher put it: "if a person remembers what he saw, his recounting it must be due in part to seeing it" (1966: 174-175; see also Bernecker 2008, 2010; Debus 2017).

[4] Mahr et al. (2025) have recently conducted a cross-cultural study investigating folk intuitions about remembering and concluded that laypeople are "intuitive causal theorists". The relationship between their findings and ours is addressed in Section 3.

Reminding and relearning scenarios, in turn, suggest that, of the various sorts of causal connection that can hold between a present representation and a past experience, a specific sort is required for remembering. The following scenario—based on the "Pete-Peggy" case described by Robins (2017a)—is a typical "reminding" scenario.

> **Reminding scenario:** John and Claire witness a car accident, but John entirely forgets it. Claire notices that John can no longer remember the accident and tells him about it. Afterwards, John forgets having been told but still remembers Claire's description of the accident. Subsequently, John entertains a representation of it based on Claire's testimony, claiming to remember it.

John's representation and the event are here causally connected via Claire's description. John's experience of the event, however, has no causal influence on the flow of information between the past event and his present representation. In other words, while *event causation* (i.e., causation by the event) is at work in this scenario, *experience causation* (causation by the subject's experience of the event) is not. According to causalists, this reminding scenario clearly does not count as a case of remembering, which suggests that remembering requires both event and experience causation.

Relearning scenarios, however, suggest that even the combination of event and experience causation is insufficient for remembering. The following scenario—based on the "friend" case described by Martin and Deutscher—is a typical "relearning" scenario.

> **Relearning scenario:** Jack witnesses a car accident, tells a friend, Kate, about it, but then entirely forgets it. Kate notices that Jack can no longer remember the accident. Based on what Jack told her, Kate tells him about the accident. Jack forgets having been told but still remembers Kate's description of the accident. Subsequently, Jack entertains a representation of it based on Kate's testimony, claiming to remember it.

Since Jack transmits information to Kate about his experience of the event before forgetting it, Jack's current representation is causally connected both to the event and to his experience of it. Both event and experience causation are thus involved in the flow of information from the past event to the present representation. Nonetheless, it is thought to be clear that relearning scenarios are not cases of remembering, as relearning subjects lose the memory traces that they formed during their original experiences of past events. In this scenario, for instance, Jack experiences an accident and forms a memory trace of it on the basis of which he tells Kate about the accident. Due to an episode of forgetting, however, Jack loses the trace in question. Although Jack subsequently entertains an accurate representation of the accident based on Kate's testimony, that trace has no causal influence on the production of the representation. This suggests that remembering requires not only event and experience causation, but also *trace causation* (i.e., causation by the trace originating in the experience of the event).[5]

On the basis of these cases, causalists conclude that remembering requires a causal connection between the subject's past experience of an event and his present representation of it that is sustained by a memory trace originating in the experience. While, in causally defective scenarios, the original trace is erased, in remembering, the original trace sustains the causal connections between the past experience of the event and the present representation of it throughout the memory process. According to CTM, remembering is distinct from accurate but causally defective representations of past events because it involves

[5] Although there is no consensus on the nature of memory traces, many philosophers have had sympathy for the inclusion of traces in the analysis of remembering. Traces have been characterized as, for example, structural analogues of past events (Martin and Deutscher 1966), distributed patterns of event features (Sutton 1998; Sutton and O'Brien 2023), dispositional properties of certain brain regions (De Brigard 2014a), and pieces of non-representational information stored in the hippocampus (Werning 2020). For overviews of accounts of memory traces see De Brigard (2014b) and Robins (2017b). For a recent view suggesting that accounts of remembering should abandon any reference to traces, see Hutto (2023). While the nature of memory traces and their role in accounts of remembering are important questions, they are beyond the scope of this paper.

appropriate causation, where appropriate causation is a matter of event, experience, *and* trace causation. Proponents of CTM thus endorse the following theory of remembering.

(CTM) A subject, S, now remembers an event, e, iff

(PE) S experienced e when it occurred;

(AR) S now accurately represents e;

(AC) S's current representation of e is appropriately causally connected to S's previous experience of e.

To summarize, the fortuitous representing scenario suggests that the previous experience (PE) and accurate representation (AR) conditions are not sufficient for remembering and that a causal condition is necessary. Moreover, the reminding and relearning scenarios suggest that a specific sort of causal condition is necessary for remembering. The former scenario suggests that event causation is insufficient. The latter scenario suggests that event and experience causation are insufficient and that trace causation is also required. According to causalists, the appropriate causation (AC) condition, with its reference to event, experience, and trace causation, captures the form of causation required for remembering.

1.2 The current studies

If we take into account the previous experience and accurate representation conditions and the distinction among event causation, experience causation, and trace causation, then we can distinguish, at least, among the six scenarios characterized in Table 1. These scenarios include a remembering scenario, the three causally defective scenarios mentioned above, and two additional scenarios. According to CTM, remembering fulfills the previous experience, accurate representation, event causation, experience causation, and trace causation conditions. Relearning fulfills all these conditions except the trace causation condition. Reminding fulfills the previous experience, accurate representation, and event causation

conditions. Fortuitous representing fulfills only the previous experience and accurate representation conditions. The two additional scenarios are "induced inaccurate believing" and "non-remembering". The former fulfills only the previous experience condition and the latter fulfills none of the listed conditions.

[Table 1 about here.]

We conducted studies in which we tested participants' intuitions via their ascriptions of remembering in five of the six types of these scenarios. As the reader will notice, we excluded induced inaccurate believing. To exemplify a scenario of this sort, suppose that a subject witnesses a car accident, forgets it, and attends a show in which a hypnotist makes him believe that he experienced an accident that has nothing to do with the witnessed accident. Subsequently, the subject entertains a representation of a car accident on the basis of the hypnotist's suggestion, claiming to remember it. As far as we know, this kind of scenario has not been discussed in the literature on memory. This is not surprising, as it is unclear what such a scenario might tell us about the nature of remembering and related phenomena. We therefore opted to exclude it from our studies.

Our studies were designed to test two hypotheses. Given CTM's purported intuitive character, our first and main hypothesis was that the intuitions motivating CTM are part of the folk concept of memory. We thus made two predictions. First, study participants would not be inclined to ascribe remembering in causally defective scenarios—such as relearning, reminding, and fortuitous representing. Second, they would be inclined to ascribe remembering in a case in which all of CTM's requirements seem to be fulfilled.

Ascriptions of remembering can, however, be ambiguous. When ascribing remembering, one might have in mind at least two things: first, that a subject simply

remembers; and second, that a subject is remembering a specific event. Therefore, we used two conditions for disambiguation purposes: the *mnemicity* condition aims to isolate ascriptions of the former kind, and the *episodicity* condition aims to isolate ascriptions of the latter kind.[6] Participants in the mnemicity condition were asked whether they agree or disagree that a subject of a given scenario remembers, and participants in the episodicity condition were asked whether they agree or disagree that a subject of a given scenario remembers a specific event. Because ascriptions of episodicity imply ascriptions of mnemicity, we expected that ascriptions of episodicity would be more demanding than ascriptions of mnemicity. We thus predicted that, with respect to a given scenario, participants would tend to give higher ratings of mnemicity than of episodicity.[7]

We conducted three studies to test our hypotheses. Mnemicity and episodicity ascriptions were collected from different groups of participants in Study 1 and from the same group of participants in Study 2. Study 1, in addition to several other scenarios, included two non-remembering scenarios, one of which behaved in a surprising way. We ran some follow-up explorations (described in the discussion section of Study 1) in order to ask for justifications from the participants, with the goal of understanding their ascriptions in the non-remembering scenario in question. The main finding was that there was an inclination for a particular interpretation of the scenario according to which internalist and non-factive criteria were prominent in ascriptions of remembering (something we did not observe in reactions to other scenarios). Since assessing subjective criteria in ascriptions of remembering is tangential to our main aim, we excluded the non-remembering scenario in question from Study 2. In Study 3, we examined whether ascriptions of remembering for a relearning

[6] It is worth noting that the terms "mnemicity" and "episodicity" are used in various ways in the philosophy of memory literature. One of the common uses of these terms is discussed in Michaelian and Sutton (2017). While our own use departs from the one discussed there, we use the terms here just for presentational purposes.
[7] While this hypothesis is not about the alleged intuitive character of CTM, we decided to include it here for two reasons. First, the hypothesis is relevant because CTM is a theory of both mnemicity and episodicity. Second, the hypothesis is useful to avoid the ambiguities of remembering ascriptions.

scenario are stable across different presentation contexts: when the relearning scenario is presented alone, when it is immediately preceded by a clear case of remembering, and when it is immediately preceded by a clear case of non-remembering. The following section describes the studies in detail and presents their results.

2 Empirical studies

2.1 Study 1

Participants. 170 study participants were recruited on Prolific: 68% female, 32% male, M_{age} = 36.0, age *SD* = 12.9, age range 18-76. In all the studies reported in this article, participants were nationals of the USA or the UK who indicated English as their first language.

Materials. Each study participant was presented with seven short scenarios (in randomized order). The scenarios are presented in the Appendix.

Each of the scenarios was followed by a question that asked participants to make an ascription of remembering. Half of the participants were in the mnemicity condition: they were always asked to indicate to what extent they agree or disagree with the claim "[Name] is remembering". The other half of participants were in the episodicity condition. The claim they received was "[Name] remembers having dinner". Participants provided their responses on a scale from 1 to 7, where 1 means "completely disagree" and 7 means "completely agree".

In addition to the target question, study participants also had to provide responses to two control questions, each tailored to check whether they grasped the key elements of the scenario. Each of the two control questions asked "According to the story, which of the following two claims is true?" and was followed by a pair of claims. The first pair of claims [Control 1] was the same for all scenarios: "[Name] in fact had a dinner in the best restaurant in town. / [Name] in fact did not have a dinner in the best restaurant in town." The second

pair of claims [Control 2] differed for each scenario and was tailored so as to stress the key element of the scenario. The latter pairs of claims are also presented in the Appendix, along with the scenarios.

2.1.1 Results

Excluded data. For individual scenarios, responses on the ascription of remembering were discarded if the participant provided an incorrect response to either of the two control questions. Proportions of discarded responses are provided in Table 2(a). The bulk of the discarded responses happened due to Control 2. Overall, very few responses were discarded for Remembering, Non-rem-D, and Non-rem-P scenarios. For Fortuitous-H, however, more than a quarter (27.6%) of responses were discarded.[8] For the remaining three scenarios, 16-18% of responses were discarded. Further analyses were conducted only on responses where both control questions were answered correctly.

[Table 2 about here.]

Distribution of responses. Histograms of responses in Study 1 are provided in Figure 1. While in the most straightforward cases—Remembering and Non-rem-D—there was a clear dominant response—1 and 7, respectively—for many other scenarios responses were very widely distributed, often with substantial clustering at particular scale points or endpoints. Given the ordered but discrete nature of the response scale, and the clear departures from approximately normal distributions, we treat the responses as ordinal and use non-parametric methods of analysis. Median responses for each scenario and each type of attribution are available in Table 3.

[8] In section 3, we briefly speculate on reasons why study participants find fortuitous representing cases especially unconvincing.

[Figure 1 about here.]

[Table 3 about here.]

Differences in ascriptions between scenarios. Data on ascriptions of mnemicity are plotted in Figure 2(a) and the data on ascriptions of episodicity are plotted in Figure 2(b). Ascriptions of both mnemicity and episodicity were very high (*Mdn* = 7) in the Remembering scenario. Ascriptions of both types were significantly lower in all other scenarios, all *p*s < .001, Holm-adjusted, CLES in the range of 90% - 99%.[9] On the other hand, ascriptions of both mnemicity and episodicity were very low (*Mdn* = 1) in the Non-rem-D scenario, with ascriptions being higher in all the other scenarios (all *p*s < .003, Holm-adjusted, CLES in the range of 63% - 99%). As for Non-rem-P, it was not interpreted as a particularly clear case of non-remembering.

[Table 4 about here]

Mnemicity vs. episodicity. In order to test our hypothesis that ascriptions of episodicity are more demanding than ascriptions of mnemicity, for each scenario we conducted a Mann-Whitney *U* test (see Table 3). For between-subjects comparisons, CLES can be understood as the probability that a score picked at random from one group (in this

[9] As an effect size, we report the common language effect size (CLES; McGraw & Wong, 1992). CLES can be understood as the probability that, if we randomly select one observation from one group and one observation from the other group, the observation from the first group will be higher than the observation from the second group, with ties counted as half-successes. We use CLES because it is suitable for data that substantially violate the assumption of normality and because it was explicitly designed to be straightforward to interpret. For example, a CLES of 85% means that, in 85% of randomly selected pairs, the observation from the first group is higher than the observation from the second group, after ties are counted as half-successes. In non-technical terms, if we compared two teaching methods and students taught with Method A tended to score higher than students taught with Method B, a CLES of 85% would mean that a randomly selected student taught with Method A would score higher than a randomly selected student taught with Method B in 85% of such pairwise comparisons, with equal scores counted as half a comparison in favor of Method A.

case, the mnemicity condition) will be higher than a score picked at random from another group (the episodicity condition). The hypothesized effect was observed in two scenarios: Relearning-D (p = .012, Holm-adjusted, CLES = 64%) and Relearning-F (p = .018, Holm-adjusted, CLES = 63%). No statistically significant differences were detected in the remaining scenarios, aside from Non-rem-P, where the opposite pattern was observed, ascriptions of mnemicity (Mdn = 2) being lower than ascriptions of episodicity (Mdn = 3, p = .012, Holm-adjusted, CLES = 35%).

2.1.2 Discussion

In Study 1, we looked at two types of ascriptions of remembering (mnemicity and episodicity) for a set of seven scenarios, ranging from what we took to be clear scenarios of remembering to clear scenarios of non-remembering and also covering less straightforward scenarios of relearning and fortuitous representing. We observed a very wide distribution of responses for a number of these scenarios, sometimes with no clear dominant response.

Ascriptions of remembering were—as per our prediction—generally lower for causally defective cases than for a clear case of remembering (Remembering),[10] providing some intuitive support to CTM. However, a quick glance at individual responses paints a somewhat less clearcut picture: a noticeable proportion of study participants ascribed remembering in some causally defective cases. This was most notable in a relearning scenario involving a diary (Relearning-D), where 50% of participants provided mnemicity scores above the scale middle point (31% provided responses below the midpoint), but some ascriptions of remembering—both mnemicity and episodicity—can be seen across all causally defective scenarios. We believe this indicates that intuitions claimed by CTM are neither clear nor univocal.

[10] While "Remembering" refers to the vignette presented to the participants, "remembering" refers in general to remembering scenarios. The distinction made via the initial capital letter is also used to distinguish the other vignettes from the general scenarios.

Regarding our second hypothesis that ascriptions of mnemicity will be higher than ascriptions of episodicity, the predicted difference was detected in two out of seven scenarios (Relearning-D and Relearning-F). Interestingly, for one of the scenarios (Non-rem-P), a statistically significant difference in the opposite direction was observed.

Overall, the Non-rem-P scenario seems to be the odd one out in light of both of our hypotheses. To learn more about potential reasons that could clarify the observed behavior of Non-rem-P, we decided to run a small follow-up study in which we ask study participants to explain their responses.

140 study participants were recruited on Prolific: 66% female, 31% male, 2% identified as non-binary, $M_{age} = 33.7$, age $SD = 13.6$, age range 18-74. There were seven scenarios and each participant received one scenario (so we had 20 participants per scenario). Five scenarios were the same as used in Study 1 (omitting the straightforward ones: Remembering and Non-rem-D). We also added a Reminding scenario (see Appendix). Furthermore, we also developed a version of the non-remembering scenario (Non-rem-B) in which, instead of a psychology researcher leading the agent to form a belief, we described an agent who received a bump on his head which, by pure chance, led the agent to form a belief (see Appendix). Study participants were asked to read a scenario and then were asked two control questions and an episodicity ascription, followed by a request to justify their ascription in one or two sentences.

The main result of these follow-up explorations was that there was a clear inclination to adopt non-factive and "internalist" perspectives about episodic remembering when considering Non-rem-P and Non-rem-B scenarios. The *non-factive perspective* was detected in justifications for high ascriptions of episodicity, suggesting that participants hold that subjects can remember events that did not occur. For instance, a participant who made a high episodicity ascription to the Non-rem-P scenario claimed: "[The subject] can recall the

experience as if he had had it, therefore he is remembering having the dinner, even if the memory was planted in his mind". Regarding Non-rem-B, another participant justified a high ascription of episodicity by saying that "although the dinner did not actually take place, in [the subject's] mind, the dinner did actually take place and although not true, he can remember the meal. Even though it did not actually happen, in [the subject's] mind it did".

The *internalist perspective* was detected in justifications for high ascriptions of episodicity, suggesting that internal criteria such as convictions and thoughts are crucial in determining whether a subject is held to remember episodically. For instance, a participant's justification for a high ascription of episodicity to the Non-rem-P scenario appealed to conviction: "[The subject] is convinced he had dinner at the best restaurant even though he did not." Another participant's justification for a high ascription of episodicity to the Non-rem-B scenario appealed to the subject's thoughts: "[The subject] thinks he remembers having dinner at the best restaurant in town, but his recollection is incorrect. However, since he *thinks* he remembers, I selected my value". In this and other provided justifications, both the non-factive and internalist perspectives overlapped. Participants claimed that internal states enable subjects to remember episodically even though the apparently remembered event did not occur.

These perspectives seem to explain the oddly high episodicity ascriptions of the Non-rem-P scenario in Study 1. While they were clearly present when considering the Non-rem-P and Non-rem-B scenarios, it was unclear whether participants took into account the non-factive and internalist perspectives when considering other scenarios. Further research is required to shed light on these perspectives and the kinds of case that trigger them.

While these are interesting research topics, our objective here is to assess CTM's alleged intuitive support. Therefore, both the study of the non-factive and internalist

perspectives and the inclusion of Non-rem-P (or any alternative formulations) were excluded from the next study.

2.2 Study 2

Participants. 180 study participants were recruited on Prolific: 67% female, 31% male, 2% identified as non-binary, M_{age} = 38.2, age *SD* = 13.7, age range 18-89.

Materials. Each study participant was presented with seven short scenarios (in randomized order). Scenarios are presented in the Appendix. Most of the scenarios were the same as in Study 1, with two exceptions. First, Non-rem-P was no longer used. Second, Reminding was added. There was one additional difference from Study 1. While, in Study 1, half of the participants evaluated mnemicity and the other half episodicity, participants were asked about both mnemicity and episodicity (with questions presented in randomized order) in Study 2. Otherwise, the materials were the same as in Study 1.

2.2.1 Results

Excluded data. Proportions of responses discarded due to incorrect responses to control questions are provided in Table 2(b). Again, very few responses were discarded for Remembering and Non-rem-D, while for the remaining scenarios the proportion of discarded responses was in the range of 14-23%.

Distribution of responses. The distribution of responses is presented in Figure 3. Again, distributions are similar to those in Study 1: clear dominant responses for Remembering and Non-rem-D and very wide distributions in responses for the other cases. The median responses for each scenario and each type of attribution are available in Table 4.

Differences in ascriptions between scenarios. Data on ascriptions of mnemicity are plotted in Figure 4(a) and the data on ascriptions of episodicity are plotted in Figure 4(b). As in Study 1, ascriptions of both mnemicity and episodicity were very high (*Mdn* = 7) in the Remembering scenario. Ascriptions of both types were significantly lower in all other

scenarios, all *p*s < .001, Holm-adjusted, CLES in the range of 84% - 99%. On the other hand, ascriptions of both mnemicity and episodicity were very low (*Mdn* = 1) in the Non-rem-D scenario, with ascriptions being higher in all the other scenarios (all *p*s < .001, Holm-adjusted, CLES in the range of 66% - 99%).

[Figure 3 about here.]

[Table 5 about here.]

Mnemicity vs. episodicity. In order to test our second hypothesis—that ascriptions of episodicity were more demanding than ascriptions of mnemicity—we conducted a Wilcoxon *W* test for each scenario (see Table 4). The hypothesis was supported in four scenarios—Relearning-D, Relearning-F, Reminding, Fortuitous-H (all *p*s < .001, Holm-adjusted, common language effect sizes in the range 64%-75%). No statistically significant differences were observed in the remaining three scenarios (Remembering, Relearning-D, Non-rem-D).

2.2.2 Discussion

In Study 2, we once again looked at two types of ascriptions of remembering (mnemicity and episodicity) for a set of seven scenarios, ranging from clear cases of remembering (Remembering, *Mdn* = 7) to clear cases of non-remembering (Non-rem-D, *Mdn* = 1), and also covering less straightforward scenarios of relearning, reminding, and fortuitous representing. We observed a very wide distribution of responses for a number of these scenarios, sometimes with no clear dominant response. For instance, in a relearning case involving a diary, 53% of participants chose mnemicity scores above the scale middle, while 36% chose scores below the midpoint. For episodicity ascriptions, the numbers were, respectively, 24% and 68%.

Regarding the second hypothesis—that ascriptions of mnemicity will be higher than ascriptions of episodicity—the predicted difference was detected in four out of seven scenarios (Relearning-D, Relearning-F, Reminding, Fortuitous-H), while in the remaining three no statistically significant differences were observed. Overall, the results of Study 2 seem to align well with those of Study 1.

2.3 Study 3

As a final study, we wanted to explore how stable ascriptions of remembering are in scenarios that violate some, but not all, of the requirements of the causal theory. In particular, we were interested in whether ascriptions of remembering for a relearning scenario depend on whether the case considered immediately before it is a clear case of remembering or a clear case of non-remembering.[11]

Participants. 229 study participants were recruited on Prolific: 50% female, 50% male, M_{age} = 44.5, age *SD* = 14.2, age range 18-83.

Materials. Participants were randomly assigned to one of three conditions. In each condition, participants were presented with the Relearning-D scenario. In two of the conditions, this scenario was preceded by, respectively, a clear case of remembering (Remembering) or a clear case of non-remembering (Non-Rem-D). Participants were asked about both mnemicity and episodicity, with questions presented in randomized order, as in Study 2.

2.3.1 Results

Excluded data. The proportion of responses discarded due to incorrect responses to control questions are provided in Table 2(c). Again, relatively fewer responses were discarded for Remembering and Non-rem-D, while for Relearning-D, 15% of responses were discarded, similarly to Studies 1 and 2.

[11] We thank an anonymous reviewer for an encouragement to address this possibility.

Effects of preceding scenario. No differences were observed in either ascriptions of mnemicity, Kruskal-Wallis, $\chi^2(2) = 5.48$, $p = .065$, or episodicity, $\chi^2(2) = 3.31$, $p = .191$, for the Relearning-D scenario across the three conditions: when Relearning-D was presented alone, when it was preceded by a clear case of remembering, and when it was preceded by a clear case of non-remembering. Thus data were collapsed across conditions for further analyses.[12]

Distribution of responses. Histograms of responses are presented in Figure 5. Again, distributions are similar to those in Studies 1 and 2: there were clear dominant responses for Remembering and Non-rem-D, and a very wide distribution in responses in the Relearning-D case. In the Relearning-D case, 55% of participants chose mnemicity scores above the scale midpoint, while 34% chose scores below the midpoint. For episodicity ascriptions, the corresponding numbers were 33% and 57%. The median responses for each scenario and each type of attribution are available in Table 5.

[Table 5 about here.]

[Figure 5 about here.]

Differences in ascriptions between scenarios. Data on ascriptions of mnemicity are plotted in Figure 6(a) and the data on ascriptions of episodicity are plotted in Figure 6(b). For both mnemicity and episodicity, ascriptions were higher in the Remembering scenario than in the Relearning-D scenario, both *p*s < .001 (pairwise Wilcoxon *W* tests); CLES = 75% and 89%, respectively. Ascriptions of both mnemicity and episodicity were also higher in the

[12] There were also no effects of order of presentation of the episodicity and mnemicity questions, all *p*s > .10.

Relearning-D scenario than in the Non-rem-D scenario, both *p*s < .001; CLES = 89% and 84%, respectively.

[Figure 6 about here.]

Mnemicity vs. episodicity. To test our second hypothesis—that ascriptions of episodicity are more demanding than ascriptions of mnemicity—we conducted a Wilcoxon *W* test for each scenario (see Table 5). The hypothesis was supported in the Relearning-D scenario, $Mdn_{\text{mnemicity}} = 5$, $Mdn_{\text{episodicity}} = 3$, $p < .001$, Holm-adjusted, CLES = 70%. No difference was observed in the Non-rem-D, but there was a small effect in the opposite direction for the Remembering scenario, $p = .033$, Holm-adjusted, CLES = 43%, both *Mdn*s = 7.

2.3.2 Discussion

In this final study, we checked whether ascriptions of remembering in the relearning case are sensitive to the immediately preceding scenario. They were not: responses to Relearning-D did not differ depending on whether the scenario was presented alone, preceded by a clear case of remembering, or preceded by a clear case of non-remembering. We interpret this as suggestive evidence that the pattern of results is robust.

Again, the results of Study 3 align well with those of the previous two studies. Participants treated Relearning-D as intermediate between a clear case of remembering and a clear case of non-remembering. Moreover, as in Studies 1 and 2, ascriptions of mnemicity were higher than ascriptions of episodicity in the Relearning-D scenario, supporting the hypothesis that episodicity is treated as more demanding than mnemicity.

3 General discussion

Our studies were designed to test two hypotheses about participants' intuitions about memory by examining their ascriptions of remembering. The first and main hypothesis was that the intuitions motivating CTM are part of the folk concept of memory. Therefore, study participants would not be inclined to ascribe remembering in causally defective scenarios—including relearning, reminding, and fortuitous representing—and would be inclined to ascribe remembering only in a case in which all of CTM's requirements seem to be fulfilled. To test this, we studied participants' ascriptions of remembering in remembering, fortuitous representing, reminding, relearning, and non-remembering scenarios.

Indeed, when subjects considered scenarios in which all the CTM's requirements for remembering seemed to be fulfilled, there was a clear tendency to provide high ratings of both mnemicity and episodicity. Likewise, when subjects considered scenarios in which none of the CTM's requirements for remembering seemed to be fulfilled, there was a clear tendency to provide very low ascriptions of both mnemicity and episodicity. However, when it comes to relearning, reminding, and fortuitous representing scenarios, the tendencies were considerably less clear. All three studies reported in this paper exhibited a similar pattern: ascriptions of remembering in these scenarios varied considerably among study participants.

The question that motivated our studies was "do laypeople share the causalist intuition that remembering does not occur in cases of relearning, reminding, and fortuitous representing?" At first glance, the fact that ascriptions of remembering—both of mnemicity and of episodicity—were generally considerably lower for these cases than for a clear case of remembering seemed to support a positive answer. Yet, the pattern of individual responses suggests a more complicated picture. While some participants denied that remembering can occur in causally defective scenarios, quite a few participants attributed high rankings of mnemicity and episodicity to relearning and reminding scenarios. A considerable proportion of our participants therefore do not seem to share the relevant causal intuitions. It is thus

unclear whether CTM in fact enjoys the intuitive support that it is thought to enjoy. While it might still be natural to think of remembering in terms of causation, it is not obvious that the folk concept of memory includes the intuitions that motivate CTM. If subjects shared causal intuitions, the ascriptions of remembering in the causally defective cases should look similar to the ascriptions in the non-remembering cases. Yet, that was not the case.

A recent cross-cultural study by Mahr et al. (2025) also investigated whether laypeople's concept of remembering aligns with CTM. Mahr et al. tested participants' intuitions about whether remembering requires that the remembered event occurred, that the rememberer personally experienced it, and that there is a causal connection between a past experience and a current representation. They concluded that laypeople are intuitive causal theorists. Our findings, however, suggest that English speakers' folk ascriptions of remembering only partly align with the theory. The key difference between their studies and our studies lies in how the causal requirement is operationalized. Mahr et al. operationalized their causal condition by asking whether participants believe the subject knows about the event because he experienced it—a formulation that remains neutral between different types of causal connection. In contrast, our study distinguishes among event causation, experience causation, and trace causation, allowing us to test more precisely whether English-speaking laypeople endorse the specific causal requirements that Martin and Deutscher identified as necessary for genuine remembering. This more fine-grained analysis reveals patterns that a coarser-grained operationalization obscures. While participants do ascribe remembering in scenarios involving appropriate causation (where all three types of causation are present), many also ascribe remembering in causally defective scenarios—particularly in relearning cases where trace causation is absent despite the presence of both event and experience causation. These findings suggest that folk ascriptions of remembering only partly align with CTM, specifically diverging on the necessity of trace causation that is central to the theory.

Our second hypothesis was that ascriptions of episodicity are more demanding than ascriptions of mnemicity. The corresponding prediction was that, with respect to a given case, participants would tend to give higher ratings of mnemicity than of episodicity. This hypothesis shaped the design of the studies. Wording can be an issue in testing ascriptions of remembering. One can ask participants whether a subject is *remembering* and trigger mnemicity ascriptions, but one can also ask participants whether a subject is *remembering a specific event* and trigger episodicity ascriptions. The fact that the latter ascriptions presuppose the former motivates our second hypothesis.

Our data suggest that there are reasons to think that ascriptions of episodicity *tend* to be more demanding than ascriptions of mnemicity. In Study 1, participants gave higher ratings of mnemicity than of episodicity in two out of seven scenarios and—setting aside Non-rem-P—there are no ratings contradicting our hypothesis. Similarly, in Study 2, participants gave higher ratings of mnemicity than of episodicity in four out of seven scenarios, and the remaining ratings do not contradict our hypothesis. Finally, in Study 3, participants gave higher ratings of mnemicity than of episodicity in the Relearning-D scenario. In particular, our studies suggest that mnemicity is more readily ascribed than episodicity in scenarios in which responses are further away from the ends of the scale (when responses are close to the ends, one can expect floor or ceiling effects). Moreover, Study 2 enabled us to observe that our prediction was more easily detected when participants were asked to provide both ascriptions. This could have happened because participants used both wordings to disambiguate the questions. For instance, if one asks participants first whether they agree or disagree with the claim "[Name] is remembering" and then whether they agree or disagree with the claim "[Name] is remembering having dinner", then it is likely that they will disambiguate the questions and, presumably, realize that episodicity ascriptions presuppose mnemicity ascriptions.

It is also worth highlighting that Non-rem-P, in Study 1 resulted in a rather surprising pattern of ascriptions of remembering. On the one hand, episodicity ascriptions were higher than mnemicity ascriptions—a pattern opposite to the one that we predicted. On the other hand, while we treated this case as a clear case of non-remembering and therefore expected very low scores of both mnemicity and episodicity, some participants took this case to be a case of remembering, especially in the sense of episodically remembering. The justifications provided by participants in the follow-up explorations of Study 1 suggested that the explanation for these surprising ascriptions may be that this scenario—and not the other scenarios used in Study 1—prompted non-factive and internalist perspectives about remembering. The non-factive and internalist perspectives, as defined above, suggest that one can genuinely remember events that did not occur and that factors internal to one determine whether one remembers an event. These perspectives might be compatible. For example, one might hold that, for a subject to remember an event, what matters is whether the subject has an internal state indicating that the subject is indeed remembering the event, regardless of whether the event in question occurred. While further studies are required to examine these perspectives, they seem to align with the folk idea that false memories and quasi-memories are genuine memories (Dranseika 2020).

In Non-rem-P, a subject participates in a psychology experiment in which a psychologist implants the belief that he experienced an event. The experiment is successful, and the subject later claims to remember the event in question (see Appendix). Participants who provided high ratings of episodicity in this scenario justified their ascriptions by appealing to the idea that, as a result of the experiment, the subject has a mental state that enables him to believe both that he experienced the event and that he remembers it. Even though the event never occurred, the mental state in question seemed to be sufficient to lead participants to attribute high ratings of episodicity.

Non-rem-B, another non-remembering scenario introduced in the follow-up explorations of Study 1, also prompted these perspectives and obtained high ratings of episodicity. In Non-rem-B, a subject is involved in an accident in which he receives a bump on his head, which leads him to believe that he experienced an event. Later, he claims to remember the event (see Appendix). Non-rem-P and Non-rem-B have in common that, as a result of some external influence, subjects end up forming mental states—participants usually referred to them as convictions or thoughts—that enable them to remember specific events that did not occur. Is this part of the folk concept of memory? While our data do not provide an answer to the question, this is a promising topic for future research in experimental philosophy of memory.[13]

If it turns out to be the case that internalist and non-factive perspectives are part of the folk concept of memory, future research will also need to study the compatibility of these perspectives with the common idea that laypeople conceive of memory as a capacity that "works like a video camera, accurately recording the events we see and hear so that we can review and inspect them later" (Simons and Chabris 2011: 3). For the view of memory as a recording device seems to presuppose that remembering is factive and the mentioned perspectives clearly depart from that view.

CTM is arguably appealing in part because it brings together two elements: a third-personal approach and an intuitive understanding of remembering (Deutscher 1989; Sutton and Windhorst 2009). While our studies were focused on the latter element, it would be worth studying the former in light of the internalist and non-factive perspectives on remembering that some of our participants adopted when considering Non-rem-P and Non-rem-B. CTM's approach is third-personal in that it adopts external or (objective) criteria to determine whether a given apparent memory is a genuine memory. But, if it turns out that

[13] For a discussion of potential lines of research in experimental philosophy of memory, see Michaelian et al. 2021.

laypeople adopt internalist and non-factive perspectives about remembering in some specific cases, then there may be tension between CTM's third personal approach and the folk concept of memory.

There is a last point that calls for an explanation. In Fortuitous-H, a subject experiences an event and forgets about it. Later, a hypnotist leads the subject to believe that he experienced the event. By sheer coincidence, the details of the event recounted by the hypnotist match the details of the experienced event. The subject then claims to remember the event (see Appendix). While most study participants in both Study 1 and Study 2 denied that this is a case of remembering, some took it to be a case of remembering. Overall, it seems that episodicity ascriptions were motivated here—at least sometimes—by the idea that the subject did not totally forget experiencing the event. Rather, the subject formed a memory of the event and, for some reason, it was repressed until the hypnotist managed to bring it back to consciousness.[14] For instance, three different participants referred to something like this idea in the follow-up explorations: "The hypnotist allowed [the subject] to revisit his memory", "[the subject] has the memories stored and the hypnotist was able to prompt him", and "the hypnotist succeeded managed [sic] to recreate the exact dinner which [the subject] had. I believe that, after this, the memory of the dinner was imprinted on his memory again". It is also worth stressing that fortuitous representing cases were cases with the highest rate of discarded responses in both of our studies. Namely, these responses were in the bulk of the cases discarded because the participant selected a response option "[The agent's] description of the dinner was accurate not by sheer coincidence, but because he can still access his old memories." This provides further evidence that study participants find the idea of irretrievably lost memories unconvincing. Further studies would be needed to understand

[14] For a critical discussion of the notion of "repressed memory", see De Brigard (2024b).

how exactly study participants interpret fortuitous representing cases and what role the folk concept of forgetting plays in that interpretation.

4. Conclusion

To summarize, our studies assessed the intuitive support enjoyed by CTM. The theory relies on intuitions about remembering, causally defective remembering, and non-remembering scenarios. In cases in which all of CTM's requirements for remembering are fulfilled and in cases in which none of them are fulfilled, participants' responses cohere with causalist intuitions: they clearly ascribe remembering in the former and clearly avoid ascribing remembering in the latter. However, it is less clear whether the ascriptions made by participants in causally defective scenarios—scenarios in which some but not all of CTM's requirements are fulfilled—favor CTM. On the one hand, causally defective scenarios result in significantly lower ascriptions of remembering, as compared to a clear case of remembering. On the other hand, the pattern of individual responses suggests that there is no clear and uniform causalist intuition. While many participants deny that causally defective scenarios are cases of remembering, others ascribe remembering in these situations or seem to be undecided. In this sense, the intuitive adequacy of CTM seems to be rather uncertain.

Our studies also suggest that certain non-remembering scenarios and certain fortuitous representing scenarios may elicit peculiar ideas about remembering. Non-rem-P and Non-rem-B seemed to elicit non-factive and internalist perspectives about remembering. Fortuitous-H seemed to sometimes elicit the idea that subjects can revisit—via the influence of hypnosis—memories that were not accessible. While it is too soon to claim that these ideas are part of the folk concept of memory, future research is required to determine exactly what kind of case elicits these less familiar ideas about remembering.

Appendix

Scenarios presented to the participants. In square brackets, information is provided on which studies the given scenario was used in. Appendix also lists pairs of statements that were used for controlling whether the participants grasped the key elements of the scenarios (differences in brackets).

Remembering [Study 1, Study 2, Study 3]

A couple of months ago, Eric ate dinner in the best restaurant in town. Today, Eric meets his friend, Alice. He tells Alice all about the dinner, claiming to remember it.

[*Control 2*] Eric's description of the dinner results [from his previous experience of having dinner in the best restaurant in town / not from his previous experience of having dinner in the best restaurant in town, but from him completely making it up].

Relearning-D (Diary) [Study 1, Study 1 follow-up, Study 2, Study 3]

A couple of months ago, James ate dinner in the best restaurant in town. The following day, he wrote all about the dinner in his diary. Several weeks later, James was involved in a minor car accident in which he received a bump on the head. As a result, he could no longer remember the dinner in the restaurant. Shortly after the accident, James read his diary and was cheered up by its detailed description of the excellent dinner that he had had. Several weeks later, James had completely forgotten reading his diary but still recalled the description of the dinner. Today, James meets his friend, Paul. He tells Paul all about the dinner, claiming to remember it.

[*Control 2*] James' description of the dinner results [from what he read in his diary / not from what he read in his diary, but from his enduring memory of the dinner itself].

Relearning-F (Friend) [Study 1, Study 1 follow-up, Study 2]

A couple of months ago, John ate dinner in the best restaurant in town. The following day, he told his friend Mary all about the dinner. Several weeks later, John was involved in a minor

car accident in which he received a bump on the head. As a result, he could no longer remember the dinner in the restaurant. Shortly after the accident, John met Mary, who, to cheer him up, gave him a detailed description of the excellent dinner that he had had. Several weeks later, John had completely forgotten meeting Mary but still recalled the description of the dinner. Today, John meets another friend, Peter. He tells Peter all about the dinner, claiming to remember it.

[*Control 2*] John's description of the dinner results [from his conversation with Mary / not from his conversation with Mary, but from his enduring memory of the dinner itself].

Reminding [Study 1 follow-up, Study 2]

A couple of months ago, Pete and Peggy ate dinner in the best restaurant in town. Several weeks later, Pete was involved in a minor car accident in which he received a bump on the head. As a result, he could no longer remember the dinner in the restaurant. Shortly after the accident, Pete met Peggy, who gave him a detailed description of the excellent dinner that they had had. Several weeks later, Pete had completely forgotten meeting Peggy but still recalled the description of the dinner. Today, Pete meets another friend, Eve. He tells Eve all about the dinner, claiming to remember it.

[*Control 2*] Pete's description of the dinner results from [his conversation with Peggy / not from his conversation with Peggy, but from his enduring memory of the dinner itself].

Fortuitous-H (Hypnotist) [Study 1, Study 1 follow-up, Study 2]

A couple of months ago, Oliver ate dinner in the best restaurant in town. Several weeks later, Oliver was involved in a minor car accident in which he received a bump on the head. As a result, he could no longer remember the dinner in the restaurant. Shortly after the accident, Oliver went to a show in which a hypnotist suggested to him that he ate dinner in the best restaurant in town. By sheer coincidence, the details of the dinner that the hypnotist described exactly matched those of the excellent dinner that Oliver had actually had. The hypnotist's

suggestion worked perfectly. Today, Oliver meets his friend, Susan. He tells Susan all about the dinner, claiming to remember it.

[*Control 2*] Oliver's description of the dinner was accurate [by sheer coincidence / not by sheer coincidence, but because he can still access his old memories].

Fortuitous-A (Amnesia) [Study 1, Study 1 follow-up, Study 2]

A couple of months ago, Brian ate dinner in the best restaurant in town. Several weeks later, Brian was involved in a minor car accident in which he received a bump on the head. As a result, he could no longer remember the dinner in the restaurant or anything else from his past. His thoughts about the past were not connected to anything he had actually experienced; any correspondence to his past experiences was purely coincidental. Today, Brian meets his friend Diane. Brian tells Diane all about a dinner that he ate in the best restaurant in town, claiming to remember it; by sheer luck his description of the dinner is entirely accurate.

[*Control 2*] Brian's description of the dinner was accurate [by sheer coincidence / not by sheer coincidence, but because he can still access his old memories].

Non-rem-D (Non-remembering, Dishonesty) [Study 1, Study 2, Study 3]

Robert has never eaten dinner in the best restaurant in town. Today, Robert meets his friend Lisa. Wanting to impress her, Robert invents a story about a dinner that he ate in the best restaurant in town a couple of months ago, claiming to remember it.

[*Control 2*] Robert's description of the dinner was [an invention that he made up in order to impress Lisa / not an invention that he made up in order to impress Lisa, but an accurate description of the dinner itself].

Non-rem-P (Non-remembering, Psychologist) [Study 1, Study 1 follow-up]

Several weeks ago, George participated in a psychology experiment in which a researcher attempted to lead him to believe that he had had dinner in the best restaurant in town. George

has in fact never eaten in this restaurant, but the experiment worked perfectly. Today, George meets his friend, Anna. He tells Anna all about the dinner, claiming to remember it.

[*Control 2*] George's description of a dinner results [from the successful psychology experiment / not from the successful psychology experiment, but from his experience of the dinner itself].

Non-rem-B (Non-remembering, Bump) [Study 1 follow-up]

Several weeks ago, George was involved in a minor car accident in which he received a bump on his head. By pure chance, the bump on the head led him to believe that he had had dinner in the best restaurant in town. George has in fact never eaten in this restaurant. Today, George meets his friend, Anna. He tells Anna all about the dinner, claiming to remember it. According to the story, which of the following two claims is true?

[*Control 2*] George's description of a dinner results [from the bump on the head / not from the bump on the head, but from his experience of the dinner itself].

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	Previous experience	Accurate representation	Event causation	Experience causation	Trace causation
Remembering	✓	✓	✓	✓	✓
Relearning	✓	✓	✓	✓	
Reminding	✓	✓	✓		
Fortuitous representing	✓	✓			
Induced inaccurate believing	✓				
Non-remembering					

Table 1. Six scenarios determined by which of CTM's requirements on remembering are satisfied.

	Discarded responses (%)		
Scenario	**(a) Study 1**	**(b) Study 2**	**(c) Study 3**
Remembering	3.5 %	2.2 %	9.1 %
Relearning-D	16.5 %	15.6 %	15.3 %
Relearning-F	15.9 %	14.4 %	-
Reminding	-	19.4 %	-
Fortuitous-H	27.6 %	21.1 %	-
Fortuitous-A	18.2 %	22.8 %	-
Non-rem-D	2.4 %	3.3 %	2.7 %
Non-rem-P	2.4 %	-	-

Table 2. Proportion of responses discarded in Study 1 (a), Study 2 (b), and Study 3 (c) due to incorrect responses to at least one control question.

Scenario	Mnemicity *Mdn* (*n*)	Episodicity *Mdn* (*n*)	Mann-Whitney *U*	*df*	p_{holm}	CLES (M > E)
Remembering	7 (89)	7 (75)	3403	162	1.00	47%
Relearning-D	**4.5 (74)**	**3 (68)**	**1765**	**140**	**.012**	**64%**
Relearning-F	**4 (73)**	**2 (70)**	**1843**	**141**	**.018**	**63%**
Fortuitous-H	2 (67)	2 (56)	1813	121	1.00	50%
Fortuitous-A	2 (78)	1 (61)	2003	137	.319	55%
Non-rem-D	1 (91)	1 (75)	3712	164	.319	41%
Non-rem-P	*2 (89)*	*3 (77)*	*4359*	*164*	*.012*	*35%*

Table 3. Median ascriptions of remembering (mnemicity and episodicity) in Study 1 and pairwise comparisons between types of attributions of remembering. Statistically significant differences in the hypothesized direction are enhanced in **bold**. Statistically significant differences in the opposite direction are enhanced in *italics*.

Scenario	*n*	Mnemicity *Mdn*	Episodicity *Mdn*	Wilcoxon *W*	*df*	p_{holm}	CLES (M > E)
Remembering	176	7	7	170	175	1.00	49%
Relearning-D	**154**	**5**	**3**	**551**	**153**	**<.001**	**71%**
Relearning-F	**152**	**4**	**2**	**580**	**151**	**<.001**	**75%**
Reminding	**145**	**4**	**2**	**509**	**144**	**<.001**	**70%**
Fortuitous-H	**142**	**3**	**2**	**505**	**141**	**<.001**	**64%**
Fortuitous-A	139	2	1	288	138	.283	54%
Non-rem-D	174	1	1	110	173	1.00	51%

Table 4. Median ascriptions of remembering (mnemicity and episodicity) in Study 2 and pairwise comparisons between types of attributions of remembering. Statistically significant differences in the hypothesized direction are enhanced in **bold**.

Scenario	*n*	Mnemicity *Mdn*	Episodicity *Mdn*	Wilcoxon *W*	*df*	p_{holm}	CLES (M > E)
Remembering	*70*	*7*	*7*	*196*	*69*	*.033*	*43%*
Relearning-D	**194**	**5**	**3**	**755**	**193**	**<.001**	**70%**
Non-rem-D	73	1	1	80	72	.884	49%

Table 5. Median ascriptions of remembering (mnemicity and episodicity) in Study 3 and pairwise comparisons between types of attributions of remembering. Statistically significant differences in the hypothesized direction are enhanced in **bold**. Statistically significant differences in the opposite direction are enhanced in *italics*.

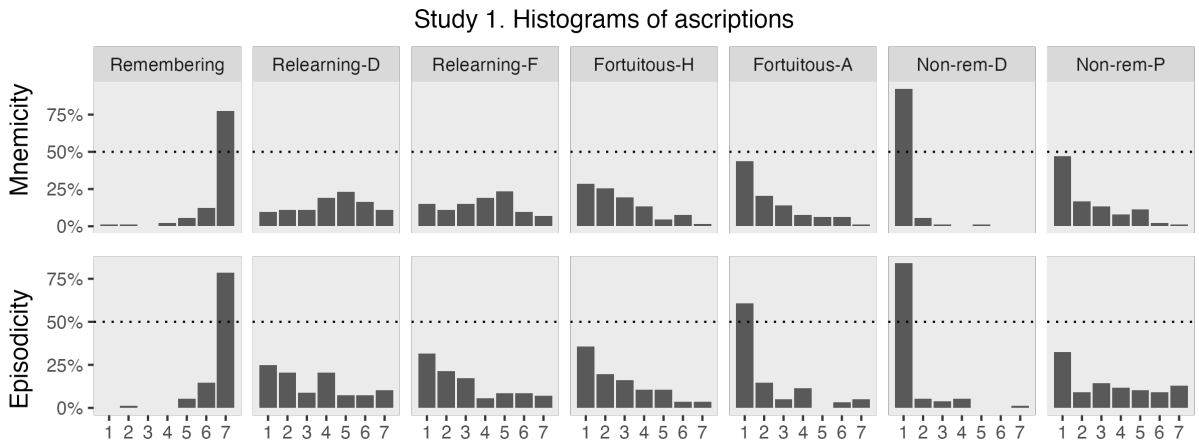

Figure 1. Distribution of attributions of remembering in Study 1 by scenario and by type of ascription.

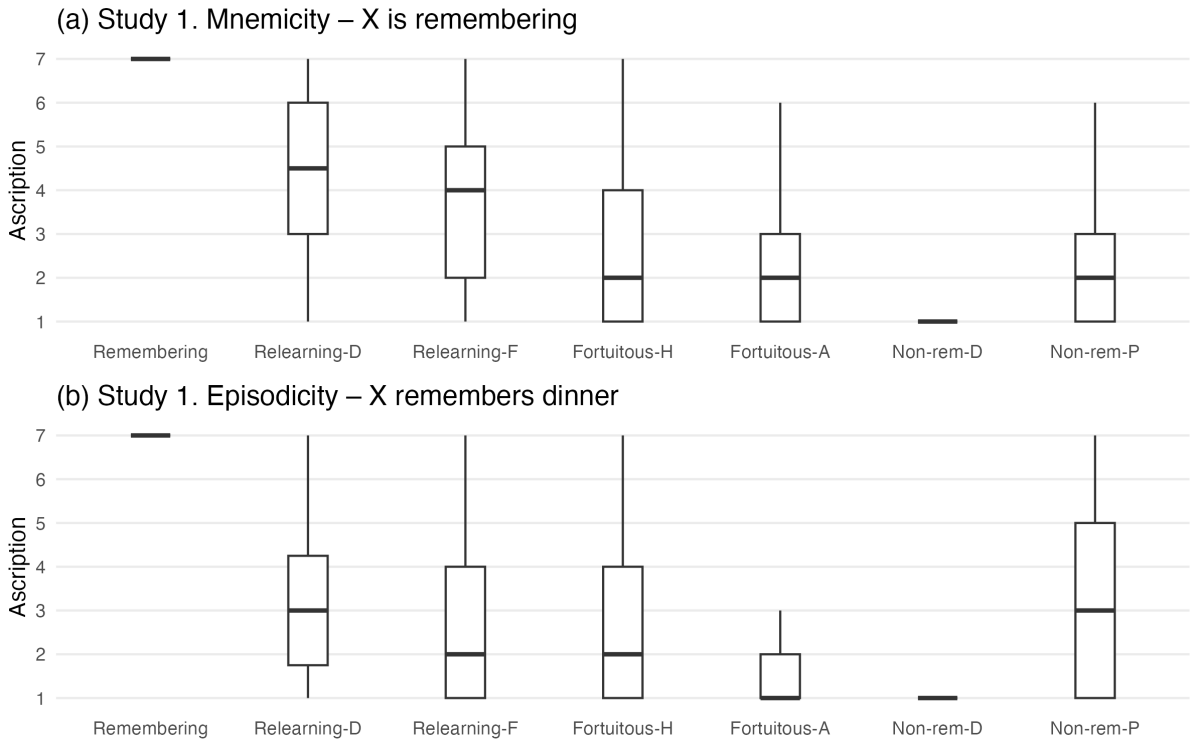

Figure 2. Distribution of ascriptions of remembering—mnemicity (a) and episodicity (b)—for each scenario in Study 1. The horizontal line inside each box represents the median. The box's edges (bounds) indicate the interquartile range (IQR), which spans the middle 50% of the data (from the 25th to the 75th percentile). The "whiskers" extend to the smallest and largest values within 1.5 times the IQR from the box.

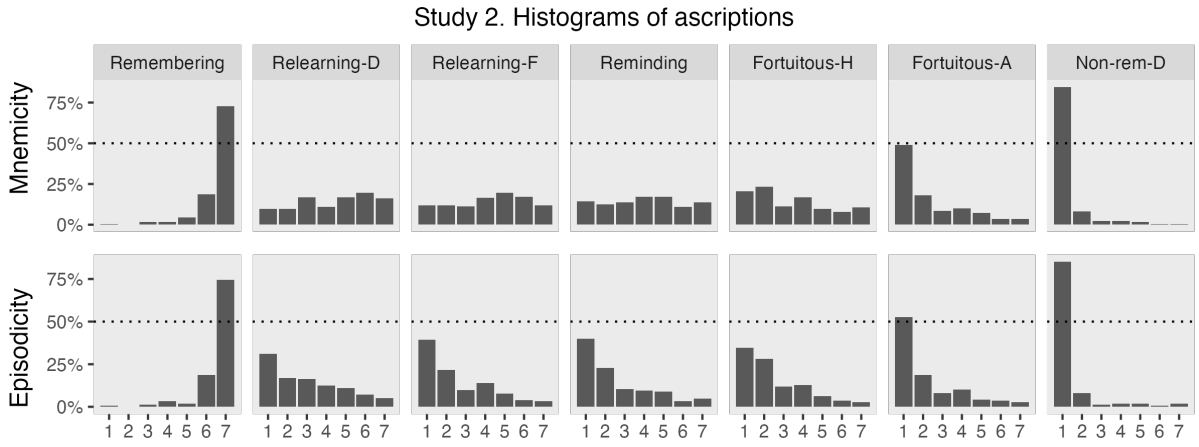

Figure 3. Distribution of attributions of remembering in Study 1 by scenario and by type of ascription.

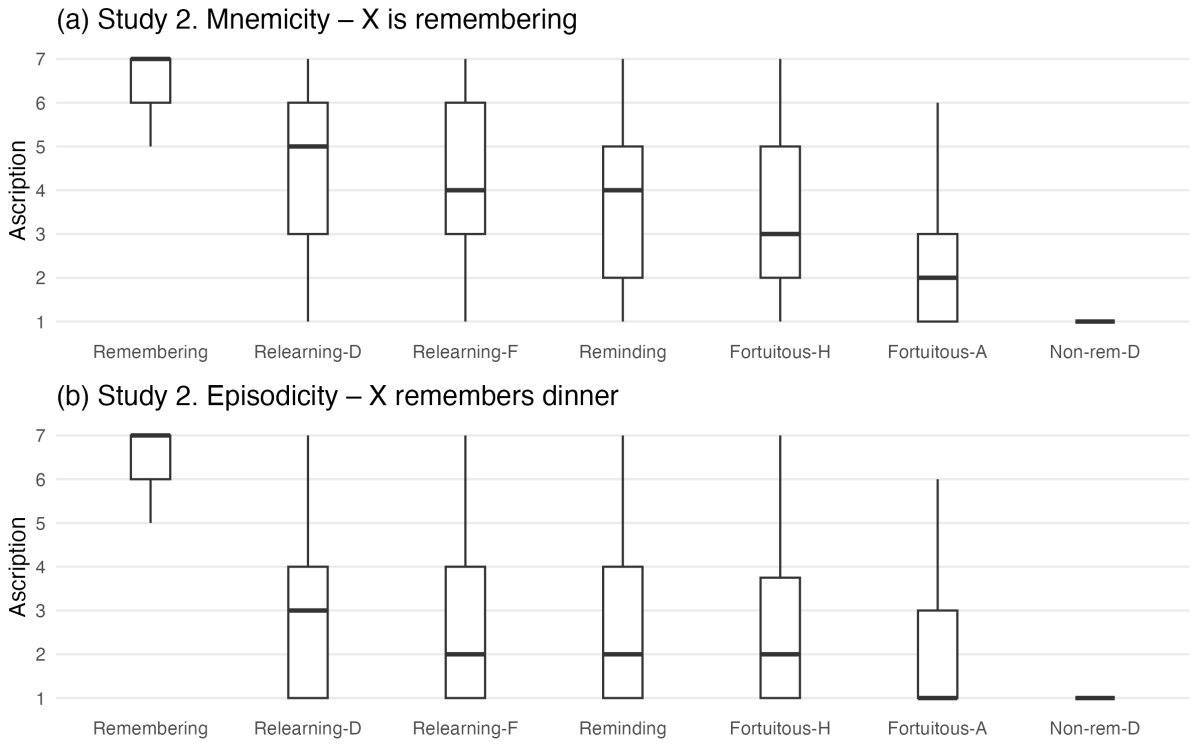

Figure 4. Distribution of ascriptions of remembering—mnemicity (a) and episodicity (b)—for each scenario in Study 2. The horizontal line inside each box represents the median. The box's edges (bounds) indicate the interquartile range (IQR), which spans the middle 50% of the data (from the 25th to the 75th percentile). The "whiskers" extend to the smallest and largest values within 1.5 times the IQR from the box.

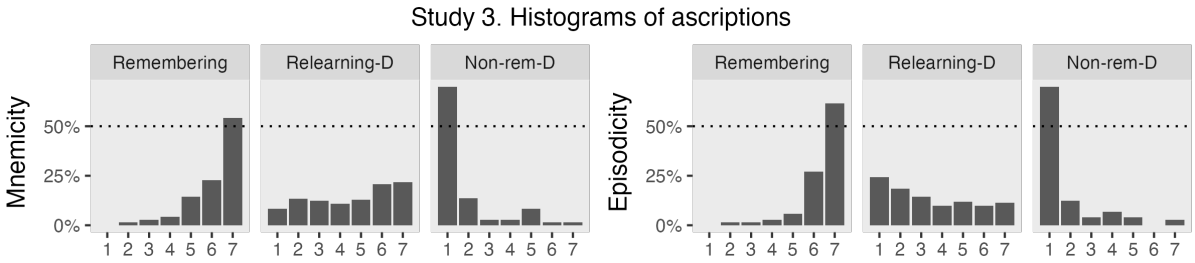

Figure 5. Distribution of attributions of remembering in Study 3 by scenario and by type of ascription.

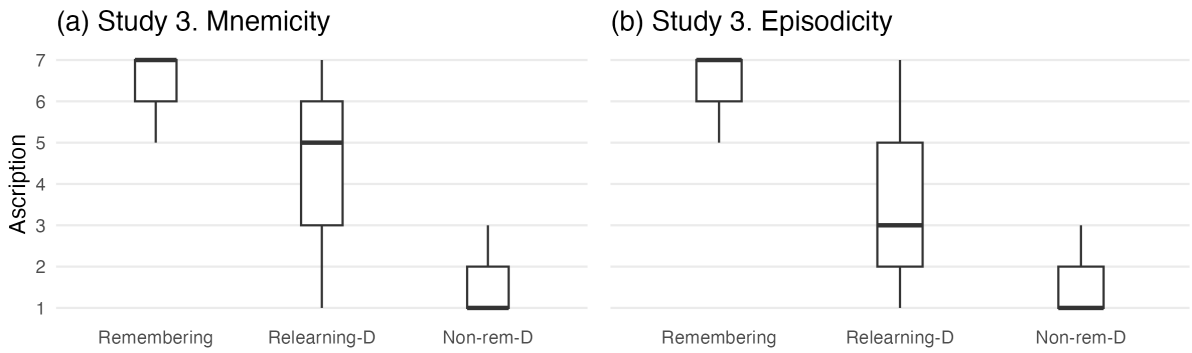

Figure 6. Distribution of ascriptions of remembering—mnemicity (a) and episodicity (b)—for each scenario in Study 3. The horizontal line inside each box represents the median. The box's edges (bounds) indicate the interquartile range (IQR), which spans the middle 50% of the data (from the 25th to the 75th percentile). The "whiskers" extend to the smallest and largest values within 1.5 times the IQR from the box.