

**Title:** Fundamental dissimilarities between the event-related potentials of remembering and imagining and their implications for continuism

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**Abstract:** Over the past two decades, considerable evidence from neuroimaging, behavioral, lesion, developmental, and aging studies has revealed important psychological and neural similarities between episodic memory and episodic imagination (for a review, see Schacter & Addis, 2020). An influential theoretical position known as "continuism" has emerged from this literature (Perrin, 2016), positing an identity between the capacity to remember one's past and the capacity to imagine one's future. As presented by Michaelian (2016), continuism involves the "same system" claim, according to which a unified neural system underlies both capacities. The same system claim was supported by the neuroimaging evidence accumulated by the episodic simulation research program. While the distinct theories that are encompassed by this research program differed in their specifics, they shared the core idea that newfound neuroimaging results pointed to a previously unrecognized neural similarity between memory and imagination. The more radical proponents believed, more specifically, that they had discovered that a single, unified brain network was responsible for both episodic memory and imagination. As we will show, this may have overstated the extent of the similarity, leading to an unjustified confidence in the conclusiveness of the same system claim.

A blind spot that may have contributed to this unjustified confidence derives from the fact that the evidence produced by the research program has a critical limitation: the neuroimaging studies relied predominantly on fMRI and PET. These techniques have coarse temporal resolution, with task epochs in representative studies commonly ranging from 4 to 16 seconds in fMRI and early PET work averaging over 30-second blocks. This temporal granularity risks blurring potential distinctions between remembering and imagining, as it can overlook dynamics that unfold faster than the tool's detection threshold. Thus, drawing conclusions exclusively on the basis of data thus gathered risks mistaking an artifact of temporal smoothing for an overlap between remembering and imagining. In the work reported here, our objective was therefore to investigate whether the continuist same system claim appears to be well supported when examined using a technique that allows for millisecond-level temporal precision. This tool is the event-related potential (ERP) technique, which has been extensively used in memory research (for a review, see Kwon et al., 2023).

The present study included nineteen participants (13 female; M age = 22 years), who completed a modified recognition paradigm. The experiment comprised 16 blocks, each with two phases. In the first phase, participants viewed 7 AI-generated images for 2000 ms each. In the second phase, 14 word-pairs were presented individually for 2000 ms. Half of

these word-pairs corresponded to images shown in the first phase (e.g., "boy-shouts" for an image of a boy shouting), while half were unrelated to any encoded images. Participants were instructed to form a vivid mental image based on each word-pair and press a key once such an image was achieved. Crucially, no reference to the previously viewed images was made during these instructions. After each trial, participants indicated whether their mental image was similar or identical to an image seen in the first phase. The remember condition included trials where word-pairs matched encoded images and participants reported both vividness and similarity; the imagine condition included trials where word-pairs had no corresponding image and participants reported vividness but no similarity to a previously shown image.

The parietal old/new effect, a well-established ERP marker of episodic recollection in recognition memory studies, was present for the remember condition but absent for imagination. This is demonstrated by a significant main effect that emerged in the 500–800 ms ( $F(1, 18) = 7.90, p = .011$ ) and 800–1100 ms ( $F(1, 18) = 10.9, p = .003$ ) windows, with the remember condition eliciting greater positivity than the imagine condition. Topographic analyses confirmed that these effects were particularly pronounced in the relevant electrodes. This dissociation suggests that the remembering and imagining conditions may engage different neural processes during this critical time window associated with episodic retrieval.

The uniqueness in the ERP signature of memory indicates that confidence in the same system claim was unjustified once temporal dynamics are examined with greater precision. As noted earlier, the experimental results of the episodic simulation research program led some researchers to conclude that a single brain network was responsible for both memory and imagination. This became a common reading of that literature and was adopted by both psychologists and philosophers. But there were, in fact, researchers within the episodic simulation program who, from the outset, put forth alternative readings that did not endorse the more radical same system interpretation. We side with these readings and propose a deflationary view. On the deflationary view, the same system claim is treated merely as a live hypothesis, one that is plausible but not one on which there is consensus or one that is self-evident. This deflation does not, however, amount to an outright rejection of the same system claim. It need not, then, mean the end of continuism.

The deflationary view does, however, suggest that continuism would benefit from revision, since treating the same system claim as a live hypothesis requires criteria for assessing whether empirical findings corroborate or undermine it. Clarifying what it means for the neural systems underpinning two mental capacities to be one and the same would provide such criteria. One way of achieving this clarification is to understand continuism as a mechanistic thesis (Camillo, 2025) according to which episodic memory and imagination manifest the same cognitive function if they are realized by similar interactions among similar neural entities. Continuism, then, does not crumble with the deflation of the same system claim; it continues to serve as a valuable framework for understanding experimental findings, now equipped with criteria that allow it to be assessed against the shifting empirical landscape.

## References:

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