Aphantasia, SDAM, and Episodic Memory

Lajos Brons*

Abstract

Episodic memory (EM) involves re-experiencing past experiences by means of mental imagery. Aphantasics (who lack mental imagery) and people with severely deficient autobiographical memory (SDAM) lack the ability to re-experience, which would imply that they don't have EM. However, aphantasics and people with SDAM have personal and affective memories, which are other defining aspects of EM (in addition to re-experiencing). This suggests that these supposed aspects of EM really are independent faculties or modules of memory, and that EM is a composite faculty rather than a natural kind. Apparent varieties of (normal and "defective") EM (as well as some closely related kinds of memory) are different combinations of these modules, and the EM construct itself adds little if any explanatory value to these modules.

Key words: episodic memory, imagery, aphantasia, SDAM, mental kinds

1

Most of the research on episodic memory of the last half century assumes (implicitly or explicitly) that episodic memory is a natural kind. Recently, Sen Cheng and Markus Werning (2016) made this claim explicitly. According to the "homeostatic cluster view" they adopt something is a natural kind if the entities belonging to that kind share a large set of inductively and explanatorily relevant properties and that kind is the largest class whose members share those properties due to some underlying causal mechanism[1]. Episodic memory satisfies these criteria they claim,

* Nihon University & Lakeland University
E-mail: mail@lajosbrons.net
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[1] This "weak" notion of natural kinds contrasts with the older and much stronger, essentialist view, and was developed mostly in response to criticism of that stronger view. (See Dupré 1993 for a noteworthy example of such criticism.) One could, of course, conceive of an even weaker view by giving up (or relaxing) one of the two cri-

and therefore, is a natural kind.

Since Endel Tulving first distinguished episodic memory from semantic memory in (1972), the concept of episodic memory has undergone a number of conceptual changes resulting in a rather large set of loose definitions and operationalizations. Essential in more recent understandings of the concept is what Tulving (1983) called the "recollective experience" or what is now more commonly called "autonoetic consciousness". Tulving (1983) writes that "when a person remembers a past event, he has a memory image of it and he is consciously aware of its being a mental replay of what happened once before" (185), and that " 'memory image' could serve as an acceptable synonym for 'recollective experience' " (186). Hence, episodic memory involves mental imagery. Furthermore, the notion of episodic memory as "replay" (or re-experiencing or reliving) of what happened once before implies that episodic memory involves a subjective identification of the remembering subject with the subject that experienced the original episode.

If episodic memory is a natural kind, then the involvement of mental imagery and subjective identification and other explanatorily relevant properties of episodic memory should be properties of that kind and should have a shared underlying causal mechanism. There are people, however, who claim not to experience mental imagery. If those "non-imagers" do have memories with many of the other relevant properties of episodic memory (such as the involvement of subjective identification), then that would imply that non-imagers have severely deficient episodic memory or no episodic memory at all, or alternatively, that episodic memory is not a natural kind but a composite faculty. The latter would be the case if episodic memory consists of a number of more or less independent components such that the composite (i.e. episodic memory) has no inductively and explanatory properties and/or no underlying causal mechanism in addition to the properties of and causal mechanisms underlying its components.

Recent research on *aphantasia*, lack of mental imagery (Zeman, Dewar, & Della Sala 2015), and on *severely deficient autobiographical memory* (SDAM; Palombo *et al.* 2015) suggests that the latter is the case indeed, or so I will argue in this paper. People with aphantasia or SDAM do not relive or re-experience episodes, but do have memories and lead otherwise normal lives, and that—in conjunction with other empirical evidence—implies that episodic memory is a composite faculty.

The aim of this paper is to reassess the nature and status of episodic memory in the light of what we currently know about SDAM and aphantasia (and related matters). Towards that end, section 2 looks into the evidence for and nature of SDAM and aphantasia, and section 3 discusses the main skeptical argument (that

teria of the "homeostatic cluster view", but such an understanding of "natural kinds" would be so weak that it is rather doubtful whether it still would be appropriate to speak of natural kinds at all.

is, Schwitzgebel's) against the existence of aphantasia. After that, sections 4 to 6 assess the implications of aphantasia for the notion of episodic memory, and section 7 concludes that episodic memory is not a natural kind (in the sense identified above) and suggests an alternative, "modular" conceptualization of the semantic/episodic distinction.

2

Usually, Francis Galton (1880) is credited with being the first to recognize the existence of people who claim not to experience imagery. Research on the phenomenon has been scarce, however, and mostly of dubious quality, until very recently. (Watkins 2018 reviews some of the earlier literature.) In 2010, Adam Zeman and colleagues published a paper reporting on a 65-year old man who had lost the ability to experience imagery but who otherwise functioned normally[2]. 21 people contacted Zeman after that, writing that they didn't experience imagery either, but that their "condition" had been lifelong. These 21 individuals were sent a questionnaire, which all of them filled in. The results were published in Zeman, Dewar, & Della Sala (2015), which coined the term "congenital aphantasia". (Until the publication of that paper "non-imager" was the most common term for someone lacking mental imagery, but it has since been replaced by "aphantasic".) Of the participants in this initial, small study, about half reported that they did not have imagery in any modality; half experienced involuntary flashes of imagery; the majority experienced imagery in dreams; the majority had difficulties with autobiographic memory; and about a quarter reported having family members with aphantasia.

The 2015 publication received a lot of public attention (albeit mostly in English-speaking countries)—it was mentioned in the popular press, popular science magazines, and on TV — leading to over 10,000 emails to the research group from people who believe that they have (something like) aphantasia, or the opposite, hyperphantasia (extremely vivid imagery). More than 2000 of those have filled in complete questionnaires. The results thereof have been analyzed mostly, but have not been published yet, except for a few remarks in a post on the research group's website (Zeman 2017). In that short report, Adam Zeman writes that the results confirm the relation with autobiographical memory, as well as the expected relation with prosopagnosia (a deficiency with regards to facial recognition), and suggests that "imagery vividness can run in families".

Aphantasia is defined in Zeman, Dewar, & Della Sala (2015) as "a condition of reduced or absent voluntary imagery". This rough definition is ambiguous in three

[2] This was not the first report of such a case. For an earlier example, see Basso, Bissiach, & Luzzatti (1980), which is discussed in section 5 below.

different ways. Most obviously, the term "reduced" immediately raises the question: Reduced to what extent (or by how much)? Furthermore, the phrase "reduced or absent" also suggests continuity between weak (or "low") imagers and non-imagers and it is presently unknown whether there is such a continuity. Although it is intuitively plausible that absence of imagery is the low extreme on a scale ranging from no imagery to extremely vivid imagery (as reported by hyperphantasics), it might turn out to be the case that non-imagers are not just very weak imagers but that there is a qualitative difference between having (very) weak imagery abilities and having no such abilities whatsoever.

Secondly, voluntary imagery contrasts with involuntary imagery, which comes in two very different kinds: involuntary flashes of imagery during wakefulness, and imagery in dreams. Given the role of imagery in autobiographic memory (e.g. Greenberg & Knowlton 2014), one would expect significant differences in memory between someone who experiences no involuntary imagery at all or only in dreams, and someone who experiences flashes of imagery related to previous experiences during wakefulness. (The occurrence of imagery in dreams also raises the question whether, when, and to what extent other kinds of sub- and/or unconscious imagery occurs in aphantasics. See also sections 4 and 6.)

Thirdly, as mentioned above, only about half of the respondents in the initial study reported lacking imagery in all sense modalities. This, of course, raises the question: How many and which kinds of imagery must be affected for the "aphantasia" label to apply? What complicates this is the number of different kinds of imagery, opacity in introspection, and the possibility of overlap. A list of kinds of imagery does not coincide with a list of sense modalities. There is no single faculty of visual imagery, for example. Instead, there are (at least) two distinct kinds of visual imagery—object imagery and spatial imagery—and these two play different roles (Kosslyn 1994). And some kinds of imagery—such as motor imagery—do not seem to be associated with particular sense modalities at all. (The other way around, while there is a sense of balance, I doubt there is imagery of balance.) It may be the case that in imagining shapes, a lack of object imagery can be compensated (at least partially) with spatial imagery and/or motor imagery. If there are such compensation effects and other interactions and overlaps between different kinds of imagery, it may be hard to keep them apart in introspection, but also in psychological tests (if those are insufficiently carefully designed). Furthermore, some kinds of imagery (such as spatial and motor imagery) may present themselves in a form that is less likely to be recognized as imagery, which further diminishes the reliability of introspection.

These considerations suggest that the least ambiguous variety of aphantasia is a condition of completely lacking voluntary imagery of any kind and lacking involuntary (flashes of) imagery during wakefulness. Nicholas Watkins (2018) calls this "total aphantasia". However, the above considerations also suggest that introspec-

tion is probably not a reliable method to distinguishing such total aphantasia—if it exists—from near-total aphantasia, and perhaps even from variants of far-from-total aphantasia. It may turn out to be the case that self-reported total aphantasia is never really "total".

Around the time of the (2015) paper by Zeman and colleagues, two other related papers were published. Daniel Greenberg and Barbara Knowlton (2014) investigated the role of visual imagery in autobiographical memory, and one of the experiments in that study involved two non-imagers (or aphantasics). Both participants had "highly abnormal ratings for reliving", which according to the authors confirms "previous work showing that mental imagery is necessary (though not sufficient) for a strong sense of reliving" (931), and which explains the aforementioned self-reported memory deficiencies of aphantasics.

Daniela Palombo and colleagues (2015) also reported on a study about "re-living" or "the subjective sense of re-experiencing" in episodic memory, and coined the term "severely deficient autobiographic memory" (SDAM) to describe three cases of healthy adults reporting not to "re-live" or "subjectively re-experience" previously experienced events. All three cases scored normal on most standard neuropsychological tests *except* for complex figure recall: their test scores were "notable for impaired recovery of visual information" (111). fMRI showed reduced activation of brain regions involved in autobiographic memory, and structural neuroimaging revealed a slight reduction in the volume of the right hippocampus, which is associated among others with the recollection of non-verbal/visual information. (On the role of the hippocampus, see section 6.)

SDAM is defined as "a mnemonic syndrome that is confined to an inability to mentally travel backwards in time in the absence of detectable neuropathology or significant daily handicap" (Palombo *et al.* 2015: 111), or more informally as "the inability to re-experience personal events" (106). All three documented cases of SDAM are also aphantasics, and it seems plausible that their aphantasia is the cause of their SDAM. If re-living experiences requires imagery, then a total aphantasic is incapable of re-experiencing mental events, and then all cases of total aphantasia would be cases of SDAM. However, someone with involuntary imagery, imagery in at least some relevant modalities, or very weak imagery would not necessarily have SDAM. The other way around, it is conceivable that someone has functioning imagery abilities, but cannot use that ability to re-live her own past. This would be a (hypothetical?) case of SDAM without aphantasia.

Although there is now a growing body of evidence for the phenomena of aphantasia and SDAM[3], much about the two conditions and their relation remains unclear

[3] In addition to papers mentioned above, Jacobs, Schwartzkopf, & Silvanto (2018) and Fuentemilla, Palombo, & Levine (2018) present further evidence on aphantasia and

and is in need of further research. Nevertheless, the available evidence makes the idea that aphantasia doesn't exist and that non-imagers are mistaken about their own experiences increasingly implausible. It is to this skeptical idea that we turn next.

3

While there has been heated debate about the status, role, and nature of mental imagery since the 1970s, both sides in that debate share a conception of mental imagery as well as the belief that the experience and phenomenology of imagery are universal (e.g. Thomson 2007). For example, Daniel Dennett wrote that "nobody denies that when we engage in mental imagery we seem to be making pictures in our head" (2002: 189). Given the almost universal acceptance of the idea that we all share the same kind of mental imagery, it should not come as a surprise that the rejection of that very idea by people who claim not to experience imagery at all has been met with considerable skepticism and even hostility. As Bill Faw observed:

> Much of the current imaging literature either denies the existence of wakeful non-mental imagers, views non-imagers motivationally as "repressors" or "neurotic", or acknowledges them but does not fully incorporate them into their models. (2009: 45)

One of the most outspoken recent skeptics is Eric Schwitzgebel. The experience of imagery is a recurring theme in a series of articles on the unreliability of introspection (2002; 2008; 2011; 2012a; 2012b). According to Schwitzgebel, "we are prone to gross error, even in favorable circumstances of extended reflection, about our ongoing emotional, visual, and cognitive phenomenology" (2008: 259). His argument is that there should be vast differences in the abilities between imagers and non-imagers (i.e. aphantasics), but there is no evidence of such differences and given that introspection is evasive and indeterminate, the most plausible explanation for this lack of evidence is that self-described non-imagers are mistaken about their own imaging abilities. Spelled out, the argument consists of three premises and a conclusion:

1) Mental imagery is evasive and indeterminate. "My experiences flee and scatter as I reflect" (2008: 267), and it is unclear, for example, how much you can visualize at once. Because of this, questions about the details of imagery are hard to answer (contrary to questions about the details of perception), and consequently, introspection of imagery is unreliable.
2) "If differences in imagery ability are as vast" as suggested by the self-reports of aphantasics and hyperphantasics, then "we should presumably expect vast

SDAM, respectively.

corresponding differences on cognitive tasks involving imagery" (2011: 44).

3) However, there is no evidence for such differences: "self-described high- and low-imagery people do not appear to perform any differently, in general, on psychological tests that have widely been thought to be aided by visual imagery" (2012a: 187).
4) Therefore, non-imagers are mistaken about their imagery experience, "differences in imagery reports do not reliably reflect differences in imagery experience" (2002: 45), and there are no substantial differences in imagery capability across individuals: "people are largely the same except when they introspect" (2008: 264).

I'll respond to the three premises (1 to 3) in the given order.

(ad 1) — In case of visual perception "we have the illusion that we are taking in all of the details simultaneously, when in fact the experience is built up sequentially" (Engelbert & Carruthers 2010: 251). If we cannot focus on the whole picture at once in visual imagery, then visual *imagery* would be very similar to visual experience, *except* that visual imagery would be lacking this *illusion* of simultaneity. This is hardly an argument for the unreliability of introspection of mental imagery (relative to the reliability of visual experience, at least).

Moreover, while the evasiveness and indeterminacy of mental imagery certainly seem to imply that we can be—and perhaps often are—wrong about the details of imagery, it does not imply that we are "prone to gross error". That we can be wrong about anything does not imply that we can be wrong about *every*thing[4]. If we would be prone to gross error in introspective judgment of our own emotions, for example, and thus would consistently misjudge how we feel, then our self-ascribed emotional states and our actual emotional states as revealed by our behavior would we completely unrelated. Aside from the fact that this obviously isn't the case, it is doubtful that this would even be possible. If there would be no relation between the observed behavior of others and their self-ascribed emotional states, it would be very difficult—and, perhaps, even impossible—to learn words to describe emotional states[5]. (A vocabulary to describe third person behavior may still be possible, but that is not sufficient.) And lacking a vocabulary for emotional states, we would be

[4] Many forms of skepticism are based on variants of this fallacious argument. The error in such arguments is a shift in the scope of the modal operator—that is, from the premise that $\forall p[\Diamond \text{false}(p)]$ in which p is a sentence or statement, it is invalidly inferred that $\Diamond \forall p[\text{false}(p)]$.

[5] How could one ever learn a word "happy" if there is no discernible pattern or continuity in the word's use? If meaning is use and/or meaning is learned in observing word use, then a lack of such patterns would make the use of the word in question apparently random, and therefore, meaningless.

unable to self-ascribe emotional states in the first place. If this is right, when it comes to introspecting emotional states, the idea of gross or massive error is incoherent. And most likely the same is true for other kinds of introspection[6].

Schwitzgebel makes a valid point when he asserts that introspection cannot tell us much about the details of what goes on in our minds. Although it is widely assumed that our minds are transparent to ourselves, as Peter Carruthers (2011) has most forcefully shown, our minds are really terribly opaque. Most of the time we have no clue about what and how *exactly* we are thinking, feeling, and so forth. Moreover, as explained in the previous section, there are independent reasons to doubt the reliability of introspection of some aspects of imagery. However, that we can be wrong about any detail of the introspective pictures we sketch of our own mental lives does not imply that we are completely wrong about all of the broad outlines. And that we can be wrong about any particular detail of (the phenomenology of) our imagery does not imply that we are wrong about not having imagery at all, or about having extremely vivid imagery.

Furthermore, Schwitzgebel's argument that introspection of imagery is unreliable is based on introspection of his own imagery, which appears to be extremely vivid (see, for example, 2012b: 37). This appears to be self-defeating, but it also nicely illustrates that researchers' theoretical views about imagery are influenced by the vividness of their own imagery (Reisberg, Pearson, & Kosslyn 2002; Faw 2009). More importantly, *if* Schwitzgebel's introspective experience entitles him to believe that he experiences imagery, then a non-imager's introspective experience entitles her to believe that she doesn't[7]. (See also Hohwy 2011.)

(ad 2) — If there are significant differences in imagery abilities across individuals, one would expect these differences to matter, but why would they imply "*vast* corresponding differences on cognitive tasks involving imagery" (emphasis added)? Many deficiencies can be compensated. A lack of imagery of some kind could be compensated by imagery of other kinds, or even by other mental faculties. (See also previous section.) If tests are not carefully designed to take that into account it is doubtful that they would find significant differences between non- or low-imagers and

[6] The argument in this paragraph is Davidsonian in spirit. See, for example, Davidson 1999.

[7] Except, of course, if there would be a reason to believe that Schwitzgebel's introspection is more reliable than that of very many self-ascribed aphantasics. But what could that reason be? It cannot be that Schwitzgebel is a philosopher, because some aphantasics are philosophers. Neither can it be that Schwitzgebel's introspective experience is "normal" while that of aphantasics is "abnormal" because, firstly, that would beg the question, and secondly, Schwitzgebel's introspective experience is probably not "normal" either, but rather appears to be "abnormal" in the opposite direction—that is, his extremely vivid imagery suggests that he is a hyperphantasic.

high-imagers.

For example, one of the most common kinds of tests that are supposed to involve imagery are mental rotation tests. Subjects get to see one figure and have to compare that figure to one or more other figures to judge whether one or more of those other figures are rotated versions of the original figure. However, if the first figure and test figures are shown simultaneously, the subject can just glance back and forth between pictures to compare details of the figures without ever forming a mental image, and even if the first figure must be remembered to do the test, the subject can remember a verbal description of the figure—provided that the figure is simple enough, which usually is the case—and then compare the test figure(s) with that description[8]. These suggestions do, of course, imply that non- or low-imagers and high-imagers use different brain regions in mental rotation tasks, and there is evidence for such a difference indeed (Logie *et al.* 2011).

If some people lack a certain mental ability, and there are ways of compensating that deficiency in many (perhaps even most) circumstances, then one would expect that deficiency only to have rather subtle effects. Considering that a lack of (specific kinds of) imagery can probably be compensated in various ways in many circumstances, if there are significant differences in imagery abilities across individuals, one would expect there to be *subtle*—but not vast— corresponding differences on cognitive tasks involving imagery, and some of those differences might only show up on an fMRI scan or by means of another imaging technique.

(ad 3) — As mentioned two paragraphs back, Logie *et al.* (2011) found that low- and high-imagers show different brain activation patterns in mental rotation tasks. The study that defined SDAM by Palombo *et al.* (2015) found that their aphantasic cases were in the severely impaired range for complex figure recall. Zeman (2017) found a link between aphantasia and prosopagnosia (reduced facial recognition). And directly contradicting Schwitzgebel's claims, Rebecca Keogh and Joel Pearson (2018) found that "congenital aphantasia is characterised by a lack of low-level sensory visual imagery, and is not due to a lack of metacognition or an inability to introspect".

There isn't *much* evidence for (the effects of) aphantasia yet, but Schwitzgebel's claim that there is no evidence is false. (But it must be noted that all of this evidence was published *after* Schwitzgebel published his main papers on introspection.) It is true, however, that most earlier studies do *not* reveal any substantial differences between low- and high-imagers on cognitive tasks involving imagery. This *apparent* negative evidence may be due to three methodological flaws, the first two of which

[8] Considering that such non-imaginistic comparison procedures might be more reliable than the use of imagery, it may even be the case that an aphantasic *who is used to* relying thereon scores higher on a simple mental rotation task than someone who is used to relying on imagery.

were already pointed at above.

Most tests ignore the possibility of compensating for deficiencies. Mental rotation tests, for example, nearly always allow for various answering strategies that do not require mental imagery. Secondly, and related to the neglected possibility of compensation, differences between low- and high-imagers are more likely to be subtle than vast and may only be revealed by means of neuroimaging. Thirdly, virtually all the research on the effects of vividness of imagery until now compares low-imagers to high-imagers, but it may be the case that low-imagers are more similar to high-imagers than to non-imagers.

To illustrate the latter, imagine a test that requires the subject to read a single, short word every once in a while. People who are very good at reading and people who can just barely read are not likely to score very differently on this test (assuming that reading skill is not correlated to whatever is tested), but people who cannot read *at all* will deviate significantly. Similarly, if a test requires only very basic imagery, low-imagers and high-imagers are not likely to score significantly differently, but non-imagers *will* (except if they can compensate for the lack of imagery).

Research into aphantasia and SDAM and their effects is still in its infancy. More research is needed, but future research also needs to take the above three methodological points into account.

Schwitzgebel's skeptical conclusion (4) about aphantasia follows from premises (1) to (3), but we have found that all three of these premises are false. Consequently, his argument against aphantasia fails. If there is no successful argument against aphantasia we should take the condition seriously and consider its implications for our conceptualizations of and research on memory. This is the topic of the remainder of this paper.

4

One of the most influential distinctions of kinds of memory is that between semantic and episodic memory by Endel Tulving (1972; 1983). Semantic memory is memory of facts; episodic memory is—more or less—memory of experienced episodes. In (1972), Tulving defined episodic memory as memory of *what/where/when*, adding the phenomenology of the "recollective experience" in (1983). The original *what/where/when* conceptualization remains influential, however, and in laboratory tests episodic memory is often operationalized as memory of visual stimuli. Consequently, the concept of "episodic memory" has become somewhat muddled.

In *Elements of Episodic Memory* (1983), Tulving listed 28 "diagnostic features" of episodic and semantic memory (see his table 3.1 on page 35). These features are a rather varied bunch including items like usefulness, likelihood of realization in ar-

Table 1 selected "diagnostic features" of episodic and semantic memory

	diagnostic feature	*episodic memory*	*semantic memory*
1	source	sensation	comprehension
2	units	events, episodes	facts, ideas, concepts
3	organization	temporal	conceptual
4	reference	self	universe
5	registration	experiential	symbolic
6	affect	more important	less important
7	retrieval queries	time? place?	what?
8	recollective experience	remembered past	actualized knowledge

(source: Tulving 1983: 35)

tificial intelligence, and admissibility as legal testimony, in addition to a number of apparently more likely candidates for defining features of the semantic/episodic distinction. (It must be noted that Tulving admitted himself that "some features may turn out to be irrelevant to the distinction" (35).) Table 1 lists the eight most relevant "diagnostic features". (Omitted features are either very similar, or consequences more than essential characteristics.)

Tulving (1983) thinks of the retrieval of episodic memory as a kind or replay or re-experiencing. Except (4) and (6), all of the features in the "episodic memory" column in Table 1 are related to this conception of episodic memory. The source of episodic memory is sense experience and its recollection is (more or less) a revisiting of that sense experience. This implies that episodic memory depends on the sense modalities—it is a replay or reconstruction of sensation. That replay or reconstruction always and by necessity involves at least one sense modality, but is often multi-modal (i.e. involving more than one sense modality). In contrast, the content of semantic memory—as characterized by the "diagnostic features" in the rightmost column in the table— is symbolic and conceptual rather than sensory-experiential, and consequently, the sense modalities play no (central) role in semantic memory. In other words, while episodic memory is necessarily sense-modal and often multi-modal, semantic memory is essentially *amodal*.

The remaining two features, (4) and (6), seem to refer to two different, albeit possibly related, aspects of episodic memory: self-referentiality (4) and the emotional attachment to some kinds of memories (6). (The first of these is what was called the subjective identification of the remembering subject with the subject that experienced the original episode in the introduction.) Mark Johnston (2010) suggested that the self is something like "an arena with some person at the phenomenological center" (237). Episodic memory is the memory of what happened in that arena and to (the subject/self at) its center. Features (5) and (8) also refer to the focus of episodic memory on that arena and its center. These features and their counterparts

for semantic memory imply that episodic memory is self-centered and, therefore, *personal*, while semantic memory—lacking any similar kind of focus —is uncentered and *impersonal*.

The role of feature (6), affect, in episodic memory is often alluded to as the "warmth and intimacy" that suffuses remembering (James 1890: 239). Supposedly, we feel an emotional attachment to our episodic memories, while semantic memories are more emotionally neutral.

The eight listed features can thus be grouped into three different contrasting pairs: (i) modal/amodal, (ii) personal/impersonal, and (iii) affective/neutral. Of these three, the modal/amodal contrast appears to be most fundamental. It may also be the most problematic.

In *Mental Time Travel* (2016), Kourken Michaelian shows that episodic memory is mental time travel into the past and that mental time travel in general is a kind of imagination. Hence, episodic memory is imagination of the experienced past. But episodic memory is modal memory and, therefore, a kind of *modal* imagination, and modal imagination is mental imagery. By implication, people who lack mental imagery—that is, aphantasics—lack modal memory, but there is nothing that indicates that aphantasics lack personal and/or affective memory (even if some of them have deficiencies—such as SDAM—in one or both of these respects).

According to Lawrence Barsalou (1999; 2009) and other advocates of "situated cognition" and similar theories there is no independent amodal memory, however. Even the memory of words and concepts involves imagery-like simulations of relevant situations in memory. If this is true, then aphantasics really do have mental imagery corresponding to their conscious thoughts, but somehow just aren't aware of it. Rebecca Keogh and Joel Pearson's (2018) findings (see above), as well as the differences in brain activation patterns between low- and high-imagers (Logie *et al.* 2011), and the documented neural correlates of semantic and episodic memory, which are often operationalized more or less as amodal and modal memory (e.g. Wiggs, Weisberg, & Martin 1998) all seem to contradict this suggestion, however[9]. Furthermore, even if it is true that the vast majority of people always activate modal memory or imagery-like simulations, this doesn't imply that all people necessarily do so. Neither Barsalou, nor anyone else has investigated whether aphantasics also activate some kind of (unconscious) mental imagery when processing apparently amodal information. Given the—admittedly still scarce— available evidence, it seems more likely that aphantasics (as well as people with SDAM) lack modal memory indeed.

[9] More specifically, it suggests that aphantasics don't have unconscious imagery that more or less systematically corresponds with their conscious mental content. It does. however, not imply that aphantasics don't have unconscious imagery at all. See also below in this section and section 6.

But if aphantasics lack modal memory, then how do they remember shapes, sounds, and other modal or sensory "information"? This question stands in need of an answer because low-imagers do not score significantly worse on mental rotation tasks (there is no separate data for aphantasics, unfortunately), and aphantasics do not appear to suffer from any cognitive impairments. The answer to this question was already (partially) given above, however: aphantasics rely on the conceptualization of modal/sensory information. In a mental rotation test, an aphantasic can compensate for her lack of mental imagery by memorizing a verbal description of the test figure. Behaviorally—that is, from a third-person point of view—the aphantasic subject will appear to have functional modal memory when doing a mental rotation test, while she is really relying on amodal memory. If this is right, then there is a kind of memory that has some apparent characteristics of both amodal and modal memory. I'll call this *pseudo-modal memory* in the following.

Pseudo-modal memory is verbalized/conceptualized and "de-modalized", abstracted, or "semanticized" sensory experience. It is memory of a visual experience of a purple triangle in the form of a description (i.e. "purple triangle"), rather than in the form of imagery. From an outside or third-person point of view, it is often indistinguishable whether someone relies on modal or pseudo-modal memory (thus explaining the normal scores of non- and low-imagers on many tests), but the phenomenology is very different. In other words, pseudo-modal memory is behaviorally (or from the third-person point of view) modal, but phenomenologically (and thus from the first-person point of view), and presumably also neurophysiologically, amodal.

While the notion of pseudo-modal memory explains some aspects of aphantasia, it also suggests a new skeptical argument against *congenital* aphantasia. If aphantasics lack modal memory and rely on conceptual, amodal, and/or pseudo-modal memory, then it seems that an aphantasic infant would have no memory at all, and because of that, would also lack the ability to learn concepts and language. Without memories of the use of the word "table" in apparent reference to things that shared certain features (i.e. tables), how could a child ever learn the word "table"? But if an aphantasic child would be unable to learn words and language, then it would not grow up to become a normally functioning adult, and consequently, aphantasia must be acquired rather than congenital.

This skeptical argument fails, however, because the memories that concept formation depends on (such as memories of tables) do not need to be conscious (and aphantasia does not exclude the possibility of unconscious imagery and unconscious modal memory). In fact, it is more likely that these memories are unconscious given that consciousness itself gradually develops in the first few years of a (normal) hu-

Table 2 amodal/modal and impersonal/personal memory

	amodal	*pseudo-modal*	*modal*
impersonal	(a)	(b)	(c)
personal	(d)	(e)	(f)

man life, while categorization by infants starts within a few months after birth[10]. Hence, the processes of category formation and (much later) of associating words with things in the earliest stages of language learning are probably largely unconscious (and automatic—we are "born to categorize", as Quinn's (2011) overview of categorization by infants and children is appropriately titled).

Moreover, if aphantasic toddlers learn language by means of something like unconscious modal memory, then adult aphantasics might also have unconscious modal memory, which would explain the self-reported occurrence of imagery in the dreams of many aphantasics[11], for example, but which would also raise further questions. Considering that unconscious modal memory appears not to be automatically and consistently activated when an aphantasic remembers something (Palombo *et al.* 2015; Keogh & Pearson 2018), What activates unconscious modal memory in aphantasics and what cognitive role(s) does it play?[12]

5

If aphantasics lack modal memory but have personal memory and affective memory (the other two aspects of episodic memory distinguished above), then these three are not just different aspects of the same kind of memory, but are two or three independent dimensions or kinds of memory instead. The three distinctions on the amodal/modal dimension combined with the personal/impersonal memory contrast results—at least hypothetically—in six different kinds of memory, as shown in Table 2.

In addition to the SDAM and aphantasia-related evidence, which supports the column distinctions, there is other evidence for some of the row distinctions in this table. Louis Renoult and colleagues (2012) argue for something they call "personal semantics", which is "highly personal (like episodic memory), yet, at the same time, devoid of any subjective sense of recollection" (550). Personal semantics lacks the modality of episodic memory—it is personal and amodal, and therefore, cell (d) and/or (e) in the table. While Renoult *et al.* points at the difference between im-

[10] On categorization by infants and young children, see Quinn (2011). On the development of consciousness in children, see Zelazo, Gao, & Todd (2007).

[11] As well as other kinds of involuntary imagery. See section 2.

[12] Answering this question is obviously outside the scope of this paper, but it should be added to the other open questions mentioned in section 2.

Table 3 ... and neutral/affective memory

		amodal	*pseudo-modal*	*modal*
neutral	*impersonal*	(a)	(b)	(c)
	personal	(d)	(e)	(f)
affective		(g)	(h)	(i)

personal and personal *amodal* memory, Hung-Yu Chen and colleagues (2017) have recently shown that impersonal and personal *modal* memory—that is, (c) and (f)—activate different brain networks.

Personal semantics as conceptualized by Renoult *et al.* includes self-knowledge, which "has most often been operationalized as the summary of one's personality traits" and "because they focus on self image, these aspects of [personal semantics] may be strongly influenced by emotional and social factors during encoding and retrieval" (555). While this suggests a link between personal and affective memory, Mark Wheeler (2000) summarizes empirical evidence that dissociates personal from affective memory. There are patients with prefrontal cortical damage (including the subjects of the psychosurgical procedure of frontal leucotomy that was performed in the first half of the 20th century) that have more or less normally functioning personal memory, but that lack an interest in those personal memories. What these patients lack is a sense of their own self-continuity and an interest in themselves as persons. And consequently, "although the patients knew all of the personal facts . . . that they did before, the facts were experienced with a lack of 'warmth and intimacy' that William James had attributed to the way humans typically think about their lives" (Wheeler 2000: 602).

Stanley Klein and Shaun Nichols (2012) describe a more recent case of a traffic accident victim R.B. who retained personal memory, but who (temporarily) lost his sense of "ownership" of his personal memories. However, R.B. experienced "full ownership" of new memories formed after the accident (and gradually recovered ownership of earlier memories) and probably because of that did not lack a sense of self-continuity as in the prefrontal cortical damage cases described by Wheeler. Nevertheless, both kinds of cases show that there can be personal memory without affective memory. The converse—that is, impersonal affective memory—appears less likely (and I'm not aware of any evidence for its existence), so this would mean that we only need to add one row to table 2, resulting in table 3.

While the evidence for the affective/personal distinction implies the need for a third row in the table, it does not specify whether that row crosses with all columns. In other words, it still needs to be established whether the affective dimension is independent from the modal dimension, and whether affective memory can be amodal (g) or pseudo-modal (h) as well as modal (i), similar to personal and impersonal memory. Although paradigm cases of affective memory appear to be modal, there is

no obvious reason why they would have to be, however.

According to Daniel Dennett (1992) and others, the self is a narrative construction. We are (more or less) the stories we tell about ourselves (to ourselves). (The idea of the narrative self has been further developed in Narrative Identity Theory within personality psychology.) In the reported cases of frontal leucotomy personal stories lose their role in narrative self-construction (which is an ongoing activity)—they become just stories without any special relevance or affect—and the subjects lose their sense of self-continuity. Which is the cause and which is its effect isn't clear exactly (to me at least), but the role these stories play *explains* their affect, and that explanation does not in any way depend on their form. That is, these stories—the elements of our self-identity—can be modal (in the form of imagery-involving recollections or re-imaginations), but they can also be amodal (i.e. more explicitly story-like). In either case, they form who (we think) we are.

There is no reason, then, to assume that affective memory must be modal (i), but this should have been obvious anyway: someone without affective memory would be like a frontal leucotomy patient, and aphantasics and people with SDAM—who lack modal memory including (i)—most certainly are not. Consequently, aphantasics (etc.) must experience (h). This doesn't establish the existence of (g), however. For a possible example of (g), see Renoult and colleagues' (2012) notion of "autobiographically significant concepts", which they assume to be part of personal semantics.

Nevertheless, while the claim that aphantasics and people with SDAM lack personal or affective memory would be implausible, they do have autobiographical memory deficiencies. Many aphantasics report having bad personal memories, and the abbreviation "SDAM" stands for "severely deficient autobiographical memory". However, these deficiencies are—most likely—not explained by deficiencies with regard to personal or affective memory but by the lack of modal memory. If autobiographical memory is roughly identical to personal memory and thus to (d) to (i) in table 3, and aphantasics and people with SDAM lack (f) and (i), which are the two kinds of modal personal memory, then they have deficient autobiographical memory indeed.

Anna Basso and colleagues (Basso, Bissiach, & Luzzatti 1980) report a case of loss of imagery. The patient "said he knew his wife to be 'small, grey haired, with almond-shaped eyes' but was unable to conjure up a picture of her in his mind" (436). This and other aspects of the case report show that the patient—after losing imagery—had to switch from inferring amodal descriptions (or "semantic" knowledge) from modal memory (*i.e.* imagery) to directly recalling stored amodal descriptions—that is, pseudo-modal memory—but lacking such stored amodal descriptions, he experienced severe memory deficiencies.

Presumably, aphantasics and people with SDAM store much more information in amodal form—or in other words, they make extensive use of pseudo-modal memory—to compensate for the lack of modal memory, but this comes with a number of disad-

vantages. Firstly, there is probably a limit to how much information can be conceptualized (or "semanticized", or "amodalized") and stored in amodal form. Secondly, this process might not be entirely automatic, and thus, if the subject doesn't remember to remember (*i.e.* store) something, it won't be remembered (*i.e.* retrieved). And thirdly, amodal memory might degrade faster and differently than modal memory. In any case, pseudo-modal memory is probably a poor substitute for modal memory in many circumstances, which explains the memory deficiencies of aphantasics and people with SDAM.

6

Tulving's list of diagnostic features was not intended as a conjunctive definition, but if it is interpreted as such, then episodic memory is the kind of memory that has *all* of those features. In other words, episodic memory is (i) in table 3. Similarly, semantic memory is the kind of memory that has all of the features in the semantic memory column of table 1 (or in Tulving's table on which table 1 is based) and lacks all of the features of episodic memory: cell (a) in table 3. The semantic/episodic distinction, then, is the (a)/(i) contrast, which raises the question what kind of memory all the other variants in table 3 are. In practice, however, episodic memory often appears to be operationalized disjunctively—that is, memory that is modal or personal or affective tends to be treated as episodic memory. In laboratory research, for example, episodic memory is sometimes operationalized as memory of pictures, which just requires (c) (or (b), perhaps) in table 3. In such a disjunctive understanding, everything except (a) would be episodic memory.

Perhaps, such apparent disjunctive understandings of episodic memory are the consequence of an implicit assumption that of the nine varieties of memory in table 3, only (a) and (i) exist. Under that assumption, which has been shown to be false above, the conjunctive and disjunctive understandings of episodic memory necessarily coincide—then all and only modal memory is episodic memory, and therefore, picture memory is episodic memory.

A similar assumption seems to play a key role in many—perhaps, even all—explanations of the evolutionary advantage of episodic memory. (See Michaelian 2016 for a critical review.) That is, the supposed evolutionary advantages of episodic memory and the related ability of mental time travel into the future are never advantages of *just* (i) but equally of one or more other variants in table 3. For example, for the abilities to avoid past mistakes and/or to plan and prepare for an uncertain future (d) or (e) are sufficient, although lacking the affective dimension the subject may be disinterested in avoiding mistakes or in planning for the future. In any case, modal imagination—which is a supposed core aspect of episodic memory—is not necessary (but this is also evident from the fact that aphantasics are just as (in-) capable of

avoiding past mistakes and planning for the future as anyone else). The only way in which supposed explanations of the evolution of episodic memory make sense as explanations thereof is if it is assumed that only episodic memory has the evolutionary relevant features, and thus none of the varieties other than (a) and (i) in table 3 exist.

In addition to implicit or explicit definitions of episodic memory as either (i) or everything but (a), some approaches opt for another variety. Both Tulving's (1972) original *what/where/when* conceptualization and Cheng and Werning's (2016) recent definition of episodic memory as involving a "temporally explicit simulation" of some previously experienced event ignore the affective dimension, for example. If episodic memory just records the *what/where/when* of an experienced event then it is the union of varieties (e), (f), (h), and (i) as any of those varieties is sufficient for that. The kind of replay or re-experiencing involved in a "temporally explicit simulation", on the other hand, would imply that episodic memory is necessarily modal and thus exclude (e) and (h), and only include (f) and (i). However, Cheng and Werning suggest that the reliving of an episode (*i.e.* the "temporally explicit simulation") may be unconscious, and that is a potential complication that doesn't readily fit into table 3.

It is not entirely clear what Cheng and Werning's suggestion is supposed to entail, but presumably the idea is that there could be unconscious (modal) re-living with a conscious amodal counterpart. In that case, conceptualization or "semantization" takes place at the time of retrieval. In a sense, the memory is really modal, but the modal aspect is hidden from the conscious mind. Such *crypto*-modal memory contrasts to pseudo-modal memory which is "semanticized" at the time of encoding. At present there is—as far as I know—no evidence for crypto-modal memory, but crypto-modal memory could explain the phenomenology of SDAM. In other words, Cheng and Werning's suggestion raises an important question: Do people with SDAM unconsciously re-live previous experiences when they (try to) remember something?

It was already mentioned that there is evidence that aphantasia is not just phenomenal and that aphantasics really use different brain areas and really lack imagery. In other words, aphantasics (probably) do *not* have unconscious imagery corresponding to and accompanying their conscious thoughts. Given the links between aphantasia and SDAM this suggests that people with SDAM do not unconsciously re-live episodes either, but it doesn't prove that. However, in neuroimaging studies, Palombo and colleagues (2015) found that brain activity that is typical for re-living is absent in people with SDAM when they try to remember. In other words, there is evidence that people with SDAM do not unconsciously re-live experiences, and thus do *not* have crypto-modal memory[13]. (However, that people with SDAM do not rely on

[13] Given the opacity of mind (Carruthers 2011), it is possible that people with normal imagery abilities and normal autobiographic memory sometimes make use of some-

some kind of unconscious modal memory when remembering does not imply that aphantasics don't have unconscious modal memory at all. See section 4.)

If semantic memory is (a) and episodic memory is (i) or some other union of cells in table 3 that excludes more than just (a)—as in the *what/where/when* interpretation and in Cheng and Werning's definition—then it is unclear how the remaining varieties of memory should be classified. These remaining varieties include impersonal modal memory (c) and its semanticized counterpart (b), as well as personal amodal memory (d) and its affective counterpart (g), but depending on the exact definition of episodic memory, they may also include (e), (f), and (h). Denying the existence of these varieties is hardly an option given the evidence reviewed in previous sections, but that doesn't automatically imply that they are really different kinds of memory in addition to episodic and semantic memory: they might be variants or applications of episodic memory that just don't make use of everything episodic memory can do, for example. In that case, someone lacking some of these variants or applications would have defective episodic memory. ("Defective" in the sense that some of the functions of episodic memory don't "work".) The plausibility of this suggestion depends on whether it can be shown that a single mental faculty is involved in everything but (a) and that aphantasics and people with SDAM have a defect in this single mental faculty explaining their lack of modal memory. In other words, it depends on explanatory and causal unification of episodic memory, and thus, on whether episodic memory is a natural kind.

7

Something is a natural kind—in the here relevant sense—if (1) the entities belonging to that kind share a large set of inductively and explanatorily relevant properties and (2) that kind is the largest class whose members share those properties due to some underlying causal mechanism[14]. These two criteria (1 and 2) are individually necessary and collectively sufficient conditions for attributing natural kind status. The first criterion demands explanatory unification of the kind in question; the second criterion demands its causal unification.

According to Cheng and Werning (2016) episodic memory satisfies both criteria, and therefore, is a natural kind. The underlying causal mechanism—criterion (2)—they identify is the hippocampus. However, while there is broad consensus that the

thing like crypto-modal memory (although I'm not aware of any evidence for this), but even if this is the case, the notion appears to have little explanatory value, and adding a fourth column to table 3 to accommodate it is, therefore, not necessary.

[14] As observed in footnote 1, one could further weaken the notion of natural kinds by giving up (or significantly relaxing) one of these criteria, but the resulting notion would almost certainly be too weak to be explanatorily useful. And therefore, whether such kinds could be justifiably considered *natural* kinds is doubtful.

hippocampus is essential for (key aspects of) episodic memory, it plays an equally important role in a large number of other cognitive contexts, and there is no consensus about the exact function of the hippocampus. In a recent review Arne Ekstrom and Charan Ranganath (2017) provisionally conclude that the hippocampus's function may be to cut up experience into spatial, temporal, or other kinds of chunks that have low variance internally. Episodes would be one kind of such chunk (but only one kind). Furthermore, there is evidence that hippocampal damage is related to a deficiency of imagery (reviewed in Ekstrom and Rangarath 2017), and Palombo and colleagues (2015) found a subtly reduced right hippocampal volume in their SDAM cases.

However, "the hippocampus is all over the cognitive map" (Ekstrom and Rangarath 2017) and its function is (or functions are) not nearly specific enough to identify it as the underlying causal mechanism of episodic memory. Moreover, the cases of deficient affective memory described by Wheeler (2000) and Klein and Nichols (2012) involved prefrontal cortical damage suggesting that the prefrontal cortex rather than the hippocampus is essential for affective memory. In other words, for causal unification of episodic memory, the role of the hippocampus is both too broad and too narrow.

The problem of narrowness can be avoided, however, by dissociating the affective dimension from episodic memory. The cases of deficient affective memory then have normal episodic memory and have an unrelated memory deficiency. Given that Cheng and Werning's definition does not explicitly involve an affective aspect, this response is available to them. Episodic memory would then be (f), personal modal memory, and (i), the kind of memory that is more commonly identified as paradigmatic episodic memory, would be a combination of episodic-memory-as-(f) and affective memory[15]. This doesn't solve the broadness problem, however, and given that the causal unification criterion requires the kind to be the largest class that shares the supposed causal mechanism, this problem appears to be fatal. The hippocampus cannot possibly provide the kind of causal unification required.

Furthermore, even if, despite these objections, the hippocampus would be identified as the underlying causal mechanism of episodic memory, this would not be sufficient to classify episodic memory as a natural kind. The other criterion, explanatory unification, requires that the things that make up the supposed natural kind also share a large set of inductively and explanatorily relevant properties (due to the underlying causal mechanism). There is no such set of properties, however. Impersonal modal memory (c) has almost nothing in common with personal amodal memory (d) or affective amodal memory (g), and certainly nothing inductively or explanatorily

[15] If episodic memory is (f), then it may be the case that many animals have full-fledged episodic memory. At least, replay in rats seems to be modal and personal, and thus (f) (e.g. Buhry, Azizi, & Cheng 2011).

relevant. Varieties of memory *in the same row or column* in table 3 share inductively and explanatory relevant properties, but those properties are related to what it says in the row and column headers and have little to do with a supposed category of episodic memory. That is, varieties of modal memory or of affective memory (and so forth) share explanatorily and inductively relevant properties.

Rather than a natural kind, episodic memory is a composite faculty. Different cells in table 3 are different combinations of different mental faculties or different "modules", and some of these modules (*i.e.* the column and row headers) may not be natural kinds themselves. I doubt that either personal memory or affective memory is a natural kind—more likely they are aspects or applications of more general mental faculties. And similarly, modal memory is probably just a particular use or function of a more general faculty of modal imagination (e.g. Michaelian 2016), and even that might not be a single faculty. The fact that non-total aphantasics report to have mental imagery in some modalities but not in others suggests that modal imagination—and therefore, modal memory—is not a single kind, but a collection of faculties (taking into account that the list of kinds of mental imagery differs from the list of sense modalities, as mentioned in section 2 above)[16].

A case could be made that episodic memory is a natural kind *if* supposed key properties of episodic memory—such as the involvement of mental imagery and subjective identification—are properties of that kind and share an underlying causal mechanism. But there doesn't appear to be such an underlying causal mechanism, and the key properties of episodic memory are not properties of that kind, but of different, other faculties that can work together, but don't always have to. The involvement of mental imagery and subjective identification are properties of modal memory and personal memory, respectively (although subjectivity may also connote affect), but modal memory and personal memory are independent mental faculties.

There are few if any inductively and explanatorily relevant properties that all of the supposed forms and varieties of episodic memory—that is, everything but (a) in table 3—share. Rather, these different kinds, uses, or functions of memory are better explained by the properties of the modules they involve: modal memory, personal memory, and affective memory. And memory that has some but not all of the supposed properties of episodic memory is not a defective or deficient form of episodic memory, but just a different combination of these memory modules.

[16] On the other hand, aphantasics typically report the lack of imagery in multiple modalities, suggesting that there may be some kind of underlying faculty tying these together, but this may be an artifact of reporting. Perhaps, there are many people who lack just one or two kinds of imagery and who never realized that because those kinds of imagery are less obvious, or because the lack of just one or two kinds of imagery doesn't seem particularly noticeable. Or perhaps only people who lack object imagery, the paradigmatic kind of imagery, realize that they are lacking something.

The episodic memory construct suggests that there is a single mental faculty responsible for very different kinds and uses of memory such as impersonal modal memory and affective amodal memory. There is no such single mental faculty, however, and consequently, the episodic memory construct obscures more than it clarifies. There is no such thing as episodic memory.

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