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Full Length Article

Aphantasia does not affect veridical and false memory: Evidence from the DRM paradigm

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ABSTRACT

Aphantasia is defined as the reduced capacity to form mental images voluntarily. Previous research provided mixed evidence regarding the effect this individual variation may have on other areas of cognition and different aspects of memory. This study investigated how a reduction in mental imagery affects verbal memory with a specific focus on false memory generation by comparing the performance of aphantasic and non-aphantasic control participants in the Deese-Roediger-McDermott paradigm. Correlational analyses revealed that higher visual imagery ability was weakly associated with better free recall performance but also more extra-list recall intrusions. However, contrary to expectations, the experimental findings demonstrated no differential effect of aphantasia on veridical or false memory in either free recall or recognition suggesting that aphantasia does not protect against verbal false memory generation. Future work should consider the effect of aphantasia on false memory generation using visual variants of the DRM task.

1. Introduction

Aphantasia is a neuropsychological condition associated with the absence or reduction in voluntary mental imagery, which can be congenital or acquired (Zeman et al., 2010; 2015). The congenital manifestation of the condition, which is the focus of this paper, is commonly identified by self-report measures such as the Vividness of Visual Imagery Questionnaire (VVIQ) (Marks, 1995) and is believed to affect around 2 % of the population (Zeman et al., 2015). Despite a reduced capacity to generate mental images voluntarily, studies have shown that developmental aphantasics perform similarly to imagers on a range of tasks assessing basic cognitive functions that are thought to be supported by visual imagery, such as visual working memory and pattern recognition (Keogh et al., 2021; Pounder et al., 2022). Similarly, single case studies of acquired aphantasia demonstrated retained visual perception, visual memory, and mental rotation despite a lack of associated subjective experience of voluntary mental imagery, although atypical brain activity was recorded whilst performing these tasks (Zeman et al., 2010; Zhao et al., 2022). The lack of, or minimal difference in behavioural performance between aphantasic and non-aphantasic individuals in a range of tasks raises questions regarding the different cognitive processes and strategies employed by aphantasics while also providing an opportunity to revisit prominent theories explaining the role of mental imagery in them. Furthermore, in a quest to better understand the condition itself, there is an opportunity to explore the cognitive and behavioural consequences of reduced visual imagery on other cognitive phenomena where it is theoretically plausible

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that individual variation in this ability may have a differential effect, such as autobiographical memory representations and false memory generation.

The relationship between mental imagery and declarative memory has received considerable attention from various perspectives in cognitive psychology. One area of research with significant focus on the mental imagery-memory link is the one concerning involuntary autobiographical memory retrieval and its association with various forms of psychopathology. The use of voluntary mental imagery to restructure or rescript emotionally charged autobiographical memories has a long history in cognitive therapy with beneficial effects (for a review see Saulsman et al., 2019), though guided visualisation techniques in this context can also lead to the generation of false memories (Arbuthnott et al., 2001; Goff & Roediger, 1998) owing to the reconstructive nature of the cognitive processes involved. Voluntary imagery of this kind is hypothesised to be constructed from combinations of multimodal sensory information stored in our declarative memory (Pearson, 2019). For example, when instructed to visualise a beach scenery, the mental image will be constructed from the individual's unique experience of beach visits, including its surrounding colours, smells, and temperature. In line with this, it has been proposed that imagining hypothetical scenarios and retrieving authentic past experiences both rely on the same constructive processes and share an overlapping neural network (Hassabis & Maguire, 2009). The cognitive cost of such constructive processes is that imagined scenarios can be a result of erroneous conjunctions of autobiographical experiences, whereby the components of an imagined event are authentic autobiographical memories but the way in which they are combined is false (Devitt et al., 2016). The top-down approach of voluntary imagery (Pearson, 2019) has recently been supported by fMRI data, and has been proposed as a reverse visual hierarchy, or vision in reverse, where the intention to generate an image begins high in cortical processing in the frontal cortex before cascading back through the memory stores of the temporal regions of the brain before ending in the visual cortex, generating the image (Dentico et al., 2014; Dijkstra et al., 2017).

Regarding verbal learning specifically, Paivio's (1986) influential Dual Coding Theory (DCT) introduces two interconnected representational systems: verbal and nonverbal (or imaginal). These systems work together to support various language-based processes including verbal learning and memory. Dewhurst & Conway (1994) tested the effect of visual imagery by explicitly instructing participants to visualise each word during encoding. Over a series of experiments (Exp. 1–4), they demonstrated that the imagery instruction enhanced the recollective experience associated with word recognition to a level comparable to the recognition of picture stimuli, thus eliminating the picture superiority effect. In addition, recognition memory was higher for high-imageable words than for low-imageable ones, with the difference being driven by the recollective experience associated with the recognition of high-imageable words, specifically (Exp. 5). Dewhurst and Conway's findings align with Paivio's (1986) dual-coding theory; mental imagery during encoding, whether that is through explicit instruction or via a pre-existing quality of the stimuli, provided additional sensory-perceptual attributes to the memory trace making imageable words easier to retrieve from memory. Better memory under conditions of an explicit imagery instruction is attributed to the additive effects of the dual code, the verbal and the imaginal, and it has been shown to be most pronounced for concrete rather than abstract words (e.g., Paivio & Yuille, 1969; McDougall & Pfeifer, 2012). Concrete words (e.g., cloud) evoke both an individual's verbal and non-verbal system by creating semantic associations (e.g., fluffy, white, sky) whilst simultaneously evoking the visual mental representation of a cloud in the mind's eye. Abstract words (e.g., theory) on the other hand are more likely to engage the verbal system alone as they are not easily visualised mentally. Therefore, when concrete words are memorised, they are coded twice in the memory trace, providing more distinct encoding than single coded abstract words. The mnemonic benefit of mental imagery in verbal learning is a robust finding which has had many educational applications (Sadoski & Paivio, 2012).

The study of individuals with aphantasia provides a novel opportunity to re-examine established theories regarding the role of visual imagery in memory, though the limited number of studies thus far provide conflicting evidence. Recent studies explored the phenomenological characteristics of autobiographical memories and imagined future events. Aphantasic participants generated significantly fewer visual-perceptual details for both memories and simulated future events compared to controls, suggesting that diminished voluntary imagery negatively affects the quality of autobiographical event representations in that they are less phenomenologically rich (Dawes et al., 2020; Dawes et al., 2022). With regards to visual memory, Beran et al. (2023) reported that aphantasic individuals performed worse in a short-term visual recognition task compared to those with average or high mental imagery. Others argued that the impact of aphantasia on memory extends to reductions in short and long-term memory in both the visual and verbal domains (Monzel et al., 2022). Yet, Siena & Simons (2024) found no evidence of an objective memory impairment in aphantasia across multiple measures of object and spatial memory tasks. More directly relevant to our study, Bainbridge et al. (2021) focused on assessing visual veridical and false memory in aphantasia using a drawing task. Participants had to remember and re-draw a series of real-world images. While aphantasics included fewer total correct objects than controls, they were also less likely to intrude false objects into the scene. By contrast, the false objects recalled by control participants were thematically associated with the remembered scenes (e.g., rug in a living room, dresser in the bedroom), as if erroneously generated by false mental imagery or driven by semantic processes. Overall, their findings suggest that the reduced ability to form voluntary visual imagery might protect aphantasic participants from generating false memories in visual tasks like this.

However, to the best of our knowledge, no studies to date have investigated the effect of aphantasia on veridical and false memories in an experimental design using word lists. A well-documented experimental induction of false memories in a laboratory setting is the DRM Paradigm (Roediger & McDermott, 1995). The task typically comprises two phases: a study phase, and a test phase. Participants are presented with multiple lists of words in the study phase (e.g. glass, open, frame…), which are semantically related to an unpresented 'critical' word (window). Participants' retention of information is then tested by free recall, recognition, or both. Studies have consistently shown that participants will recall and/or recognise the non-presented critical words at a similar rate to presented words, demonstrating the false memory effect (Pardilla-Delgado & Payne, 2017). Given the robustness of the effect, this memory error has been conceptualised as a typical phenomenon in the adult population.

Based on the theories and findings outlined above, it could be argued that individuals with aphantasia—who have a reduced ability to voluntarily generate mental images—would not receive the same dual coding mnemonic benefits to increase retrieval accuracy in the DRM task and would thus demonstrate poorer verbal memory performance characterised by decreased veridical memory compared to those without aphantasia, though the potential influence on false memory is less clear. DRM studies that took individual differences in mental imagery ability into account have produced inconsistent results. Winograd et al. (1998) reported a significant positive correlation between VVIQ scores and false recognition, indicating that poor imagers were less likely to falsely recognise unrelated and critical words. Later studies by Pérez-Mata et al. (2002) found VVIQ to be weakly related to correct recall but not related to false recall, and no influence of VVIQ scores was established on the pattern of recall when entered as a covariate. Such results indicate no consensus as to how individual differences in mental imagery ability affect performance in the DRM paradigm.

Building on Dewhurst and Conway's (1994) work, some studies further investigated the effect explicit mental imagery instruction had on DRM performance. Here as well, findings were inconclusive with some studies showing no significant effect on either veridical or false recall (Newstead & Newstead, 1998), others demonstrating a benefit to correct recognition in good imagers only (Marmurek & Hamilton, 2000), or benefit to correct recall and recognition in the context of significant reduction in false recall but no effect on false recognition (Robin, 2011).

Taken together, what emerges from the literature is that mental imagery might affect false memory recognition and recall differently. The very limited data currently available suggest that mental imagery might bias recognition memory decisions to promote false recognition whilst also increasing veridical recognition. Therefore, diminished mental imagery ability, such as in aphantasia, might benefit people by making them less prone to generate false memories in recognition tests. By contrast, as mental imagery has the potential to enhance memory accuracy in free recall tests (i.e. increased correct and reduced false retrieval), aphantasic individuals may be less likely to benefit from this mnemonic effect.

The inconsistent findings thus far warrant the need for further studies from novel perspectives. The present study implements a neuropsychological design, including congenital aphantasic adults and non-aphantasic controls to examine the effect of mental imagery ability on veridical and false memory for verbal material. For the first time in this population, we adopted a verbal DRM task, provided explicit visualisation instructions during encoding, and compared the performance of participants with or without aphantasia on verbal recall and recognition. We were also motivated to explore the sample data from an individual differences perspective. Here, rather than grouping participants based on a VVIQ cutoff score, the relationship between VVIQ scores and measures of false and veridical recall and recognition were tested in the sample as a whole.

Individuals with aphantasia are at the lower end of mental imagery ability and should, based on the DCT, demonstrate pervasively poorer verbal memory performance in terms of correct retrieval. More specifically, and in line with the DCT, mental imagery allows individuals to generate additional sensory-perceptual qualia during encoding, which can be used to discriminate between perceived and falsely generated stimuli and thus increase veridical memory and potentially reduce false memory via reality monitoring (Dodson & Schacter, 2002; Stephan-Otto et al., 2016), though the evidence on the latter is less clear. As aphantasic individuals' ability to utilise mental imagery during encoding is diminished, they should not benefit from these proposed mnemonic influences. Therefore, based on the DCT and the associated empirical evidence outlined above, it was expected that their performance in the DRM task would be characterised by reduced veridical memory performance in recall and recognition, relative to controls. However, due to the inconsistent findings in the literature regarding the effect of individual differences and imagery instruction on false memory across recognition and recall tests, our hypotheses regarding aphantasia's effect on false memory are provisional. As a working hypothesis we anticipated that false recognition would be lower in aphantasia relative to controls, but we made no specific hypothesis for recall.

2. Methods

2.1. Design

A mixed experimental design was implemented with population group (aphantasic vs. control) as a between-subject factor, and word type as a within-subject factor. Group membership was identified by participants' mental imagery ability as defined by their VVIQ score. Participants were tested by means of free recall and recognition, and analyses were carried out separately on the dependent variables yielding a 2 x 2 and 2 x 3 design, respectively. For recall, the dependent variable was expressed as the mean proportion of studied and critical word recall across the six studied lists. For recognition, the dependent variable was expressed as the participants' recognition rate (i.e. mean proportion of recognised items) for the studied, unrelated distractor, and critical distractor words across the test list.

In-line with an individual differences perspective, the sample data were also explored using correlations where the relationship between VVIQ scores and the above-described recall and recognition memory measures was tested. In addition, a measure of extra-list intrusions (i.e., recall intrusions that were not part of the studied list, not including the critical word) was also calculated for each participant by taking the sum of extra-task intrusions divided by six (i.e., the number of study lists) to include in these analyses as an alternative measure of false memory generation.

2.2. Participants

Participants were recruited from the community via targeted and opportunity sampling to include aphantasic and control participants. Links to the study were posted in popular aphantasic forums on both Reddit (*R/Aphantasia*) and Facebook (*Aphantasia (Non-Imagery / Mental Blindness) Awareness Group*) as well as the university's participant pool site 'Sona' and various social media platforms.

Ethical approval for the study was granted by the Psychology Local Research Ethics Committee of Leeds Beckett University.

The sample consisted of 198 participants including 113 in the aphantasic group (61 females, mean age 34.8 years, range 18–77) and 85 in the control group (42 females, mean age 34.0, range 18–99). Participants were grouped based on their VVIQ score using the stricter criterion for identifying aphantasia, as defined by Zeman (2020). Aphantasic participants had a VVIQ score of 16–23, whilst control participants had a score of 24–80. In our sample the median scores on the VVIQ were 16/80 (i.e. at floor) and 45/80 in the aphantasic and control group, respectively. The groups were matched on age, $t(196) = 0.371$, $p = 0.711$, $d = 0.05$. All participants spoke English as their native language.

To estimate the expected effect size, we referred to two recent studies with similar 2 × 2 designs examining imagery group by recall performance: Bainbridge et al. (2021; aphantasic $N = 61$, control $N = 52$) and Dawes et al. (2022; aphantasic $N = 30$, control $N = 30$). Both studies reported significantly reduced recall performance in aphantasic participants relative to controls using different manipulations. Bainbridge et al. reported a medium effect size of $f = 0.295$ (converted from $\eta_p^2 = 0.08$), while Dawes et al. reported a large effect size of $f = 0.484$ (converted from $\eta_p^2 = 0.19$). Based on these findings, we selected the more conservative estimate of a medium effect size ($f = 0.25$), which is also the default in G*Power (Faul et al., 2007). Using G*Power, we found that a sample of 128 participants would be required to detect a group effect with 80 % power. Our sample of 198 participants therefore yields an estimated power of 93 %.

2.3. Materials

For the study phase, 90 words were used in total. Six DRM lists were taken from Stadler et al. (1999) with each list comprising 15 semantically related words ordered in decreasing associative strength with its respective critical word. For example, in the study list associated with the non-presented critical word *window*, the words included were *door, glass, pane, shade, ledge, sill, house, open, curtain, frame, view, breeze, sash, screen, shutter*. DRM recognition tests are typically compiled to include three words of the same position from each studied list (arranged in descending semantic association), the associated critical word and a set of unrelated distractors. In line with this, the recognition test comprised 48 items; 18 studied words taken from positions 2, 8, and 10 from each list, 6 critical distractor words associated with the presented lists and 24 unrelated distractor words taken from six non-presented DRM lists (see Supplementary material). DRM study lists were audio-recorded with Audacity. Free text to speech software provided by Microsoft Azure was used to record each word to ensure consistent and clear pronunciation.

The 16-item Vividness of Visual Imagery Questionnaire (Marks, 1973) was used to ascertain participants' visual imagery ability. In this version the original order of the 5-point scale is reversed such that higher scores reflect more vivid imagery leading to a maximum score of 80 (Zeman et al., 2020). The questionnaire asked participants to rate the vividness of perceived mental images for specific scenes and situations. For example, "Visualize *a rising sun. Consider carefully the picture that comes before your mind's eye*".

2.4. Procedure

The experiment was implemented and hosted on the online platform 'Testable'. Participants followed a web link to Testable to complete the study online. Once they generated their unique ID and provided demographic information, they completed the following tasks:

Participants were presented with the six DRM lists auditorily only, without a visual display of the words on screen, and were

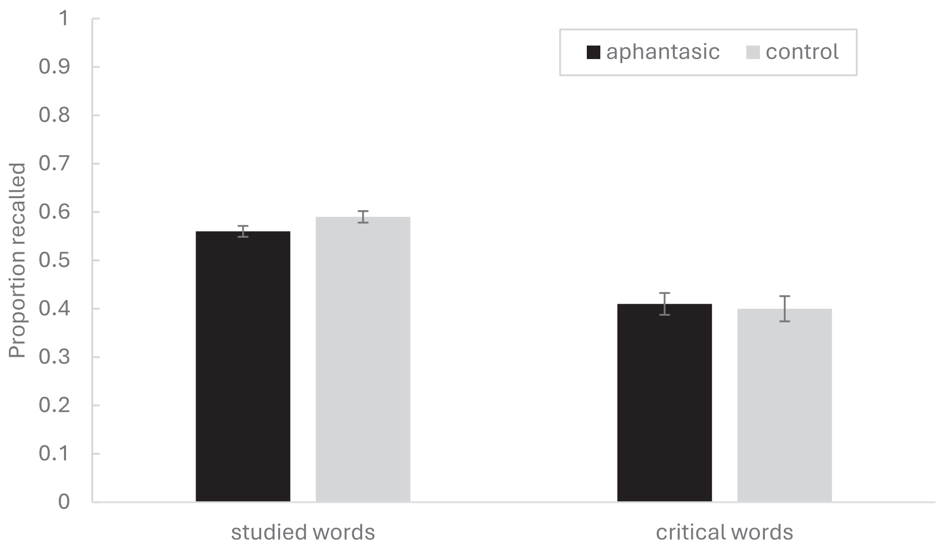

Fig. 1. Proportion of studied and critical words recalled by aphantasic and control participants. Note. Error bars represent one standard error of the mean.

instructed to visualise each word whilst listening. To ensure optimal listening conditions, participants were recommended to wear headphones during the word presentation. They were also informed that that their memory for the lists would be tested later. The lists were presented in a fixed order with a 2 sec inter-stimulus interval between each word. A tone was played to denote the end of each list. After the tone, participants were asked to recall as many words as they could from the list and type their answer in the space provided. There was no time limit for recall, however, participants were prevented from advancing to the next list before they provided their answer. This procedure was repeated for the remaining five lists.

Following the presentation of all lists, participants were presented with the 48-item recognition test. The words were presented one at a time visually on the computer screen in a different random order for each participant. Participants were asked to indicate whether the word had been presented previously in the study phase by clicking buttons labelled 'yes' and 'no' before advancing to the next word.

Next, participants completed the modified version of the 16-item Vividness of Visual Imagery Questionnaire (Marks, 1973).

3. Results

3.1. Recall

Participants across the two groups recalled 57 % of the studied words in the context of falsely recalling 40 % of the critical words, on average. In addition, they intruded 0.21 extra-task words per list into their output, on average. A 2 x 2 (group x word type) mixed ANOVA showed a main effect of word type, $F(1, 196) = 82.09$, $p < 0.001$, $\eta_p^2 = 0.30$, with greater recall for studied words than critical words. However, there was no effect of group, $F(1, 196) = 0.09$, $p = 0.77$, $\eta_p^2 < 0.01$, and there was no word type by group interaction, $F(1, 196) = 1.60$, $p = 0.21$, $\eta_p^2 = 0.01$. Means are displayed in Fig. 1.

3.2. Recognition

Participants across the two groups correctly recognised 84 % of the studied words in the context of falsely recognising 79 % of the critical and 5 % of the unrelated distractors, on average. A 2 x 3 (group x word type) mixed ANOVA showed a main effect of word type, $F(1.39, 272.62) = 1601.82$, $p < 0.001$, $\eta_p^2 = 0.89$. Bonferroni-corrected pairwise comparisons revealed significant differences between the recognition rate of studied and unrelated, and critical and unrelated words (both at $p < 0.001$) as well as between studied and critical words ($p = 0.02$). There was no main effect of group, $F(1, 196) = 0.65$, $p = 0.422$, $\eta_p^2 < 0.01$, and there was no word type by group interaction, $F(1.39, 272.62) = 0.087$, $p = 0.847$, $\eta_p^2 < 0.01$. Means are displayed in Fig. 2.

3.3. Correlations

The association between the VVIQ score and all memory measures (i.e., studied, critical word recall and extra-list intrusions; studied, critical and unrelated word recognition) was also explored using two-tailed Pearson's correlations which yielded two notable findings. There was a significant weak positive correlation between the VVIQ score and the proportion of studied words recalled, *r*

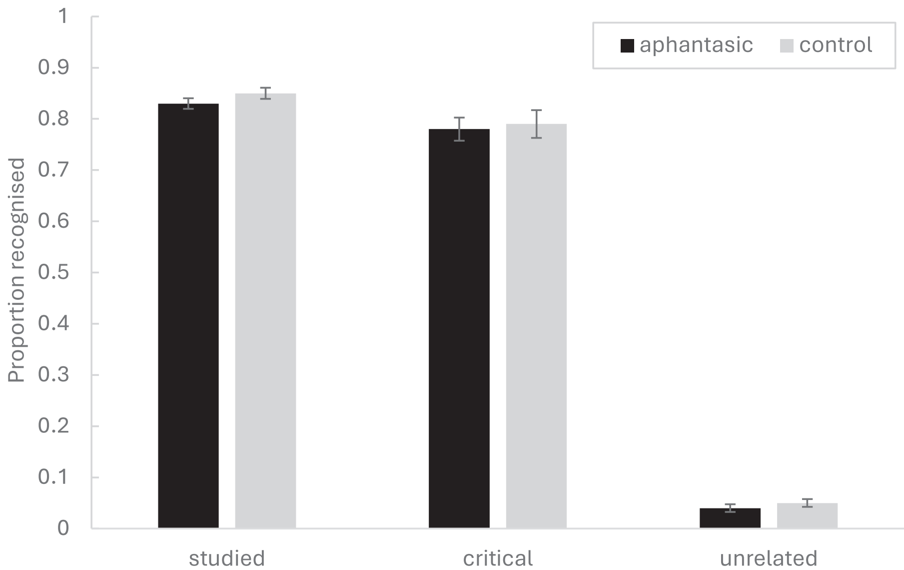

Fig. 2. Proportion of studied, critical and unrelated distractor words recognised by aphantasic and control participants. Note. Error bars represent one standard error of the mean.

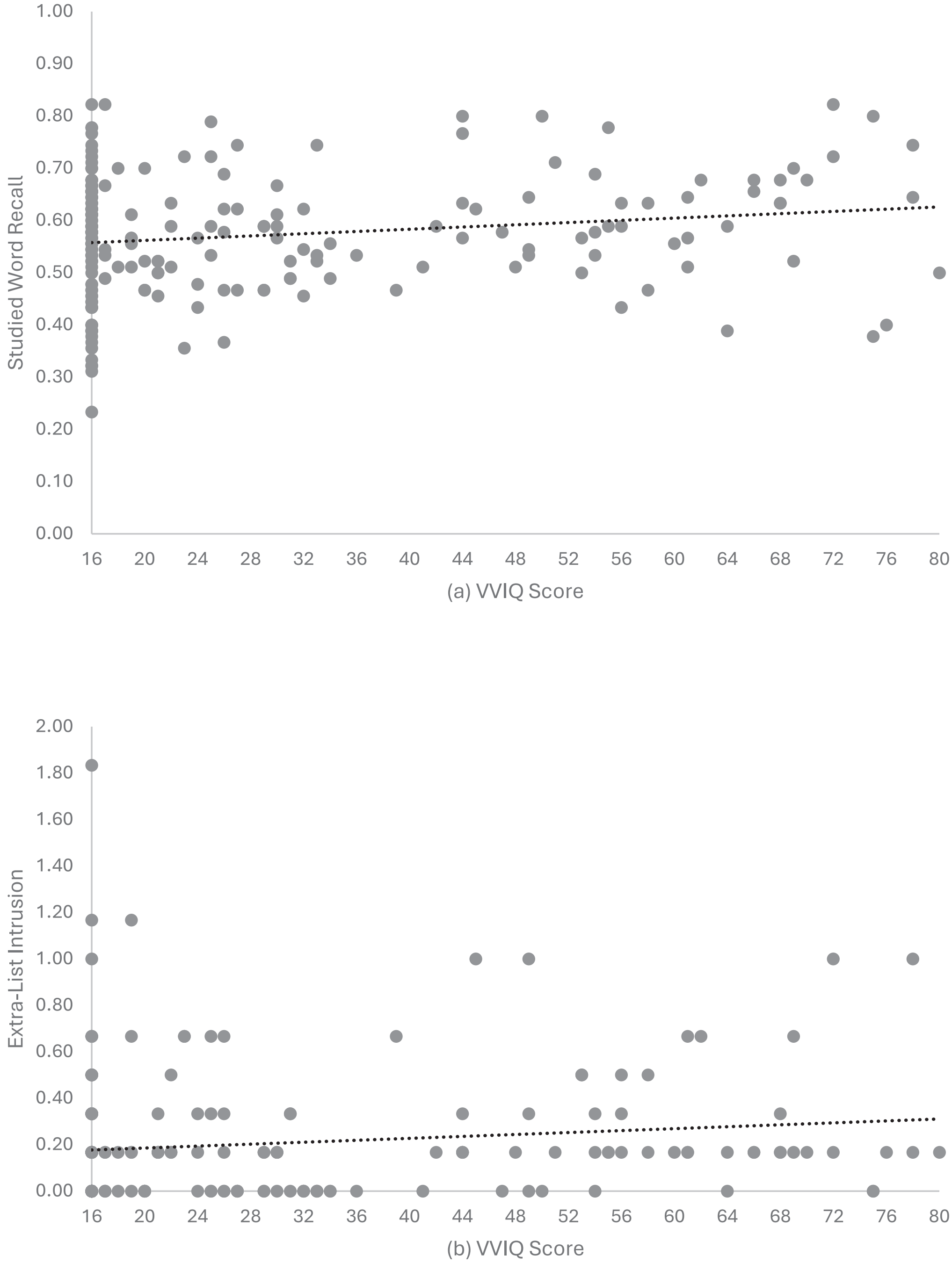

Fig. 3. Scatterplots depicting the correlations (a) between VVIQ scores and studied word recall expressed as proportions and (b) between VVIQ scores and extra-list intrusions expressed as average per list.

(196) = 0.172, $p = 0.016$, and a significant weak positive correlation between the VVIQ score and the average extra-list intrusions, r (196) = 0.141, $p = 0.047$, (Fig. 3). All other correlations were non-significant.

4. Discussion

This study compared aphantasic and non-aphantasic participants in the DRM experiment testing veridical and false memory in the verbal modality. The study aimed to shed further light on the mnemonic influences of visual imagery in the context of false memory generation and add to the growing body of literature on understanding the cognitive correlates of aphantasia. The study has replicated previously reported patterns of data with regards to the DRM effect in an online environment, namely that participants tended to endorse disproportionately high numbers of critical words as previously seen especially when tested by means of recognition. Pertinent to the hypothesised group effects, however, only small numerical differences were identified in the predicted direction such that aphantasic participants recalled and recognised fewer studied items and recognised fewer critical words at test, but these group differences were not statistically significant. Therefore, our experimental findings suggest that aphantasia does not have a differential effect neither on veridical memory nor on false memory generation in the DRM paradigm, at least under the specific experimental parameters applied here. Such findings, though unexpected, seem to partially align with recent evidence from a mock eyewitness study. Dando et al. (2023) found that whilst veridical recall of information was reduced in the aphantasic group, their accounts did not include more false information than that of the control group. Our findings warrant consideration of alternative explanations for verbal processing in aphantasia alongside study limitations.

In our study all participants were explicitly instructed to visualise the words at encoding, and it was anticipated that such an instruction would lead to observable group differences due to aphantasic participants' markedly reduced ability to engage with the instruction. Our hypotheses around pervasively poorer correct retrieval were motivated by a frequent explanation for the mnemonic benefits of mental imagery, the distinctiveness heuristic, which builds upon Paivio's Dual Coding Theory (1986). Visualisation of words during encoding adds distinct sensory-perceptual attributes to the memory trace. These distinct attributes can be used during retrieval to facilitate effective source monitoring of the memory trace to enhance veridical memory whilst potentially reducing false memory (Dodson & Schacter, 2002; Schacter et al., 1999). Contrary to expectations, the performance of aphantasic participants was statistically indistinguishable from that of typical imagers. The lack of between group differences suggests either that typical imagers did not benefit from visualisation, or more plausibly, that aphantasic participants benefited from 'visualisation' or another strategy as did controls. Whichever is the case, this finding is in contrast with some previous work demonstrating that visualisation instructions produce mnemonic benefits in recall (Dewhurst & Conway, 1994; Newstead & Newstead, 1998; Robin, 2011) and recognition (Foley et al., 2006; Marmurek & Hamilton, 2000; Robin, 2011) which we expected to see in the control group of typical imagers based on the distinctiveness heuristic, although the effects were not found consistently in previous studies (Newstead & Newstead, 1998; Roediger et al., 2001). By contrast, theoretically, aphantasics should not have received the mnemonic benefits of the additional sensory-perceptual qualia that is visual in nature as they cannot generate them at encoding, but they may have relied on alternative qualia or cognitive strategies to compensate for their lack of visual imagery. Indeed, a recent study by Keogh et al. (2021) showed that aphantasics use different, non-visual imagery based cognitive strategies to solve visuo-spatial working memory tasks which mean no disadvantage to them in terms of their accuracy and capacity when compared to non-aphantasic controls. Relatedly, it is difficult to appreciate how people with congenital aphantasia may interpret an instruction to *visualise* verbal material. As noted by others, visual imagery can take on a metaphorical rather than literal meaning in aphantasia where mental imagery is driven by another modality (e.g. auditory imagery) or even conceptually (Zeman, 2015; Keogh et al., 2021). Given that the words in our study were presented in auditorily rather than visually during encoding, this might have further supported some aphantasic participants by aligning more closely with their reliance on non-visual strategies. Future studies should assess the effect of presentation modality on memory output by systematically manipulating it at encoding and at test in groups of aphantasic and control participants to better appreciate the role of auditory processing. Relatedly, an acknowledged limitation of our study is the lack of inclusion of a cognitive strategy questionnaire, which should be explored in future studies in the context of the DRM experiment to shed further light on any processing differences in aphantasia. Finally, an alternative possibility is that mental imagery may not play a major role in memory performance in the verbal DRM task. From this perspective, the lack of a difference between the performance of aphantasic and control participants can be explained by neither group relying on and/or benefiting from visualising the words presented at study. Future research adopting a visual variant of the DRM task involving scenes (Děchtěrenko et al., 2021) or using words as well as pictures as thematically related stimuli in this paradigm (Foley & Foy, 2008) would be particularly relevant in an aphantasic sample as a next step to help disentangle the role of mental imagery in false memory generation.

Other than categorising participants into the experimental and control group, the VVIQ measure was also utilised as a continuous variable to test if individual differences in mental imagery ability correlated with any of the memory measures. These analyses revealed two notable findings: higher imagery ability was associated with greater veridical memory (i.e. studied word recall) and with more false memory generation in the form of extra-list intrusions into recall. Our findings are in line with earlier work exploring the memory correlates of visual imagery ability. For example, Pérez-Mata et al. (2002) identified positive associations between VVIQ scores and veridical recall of verbal material, while others have demonstrated the same relationship with false recognition (Winograd et al., 1998). In addition, similar observations were made for visual material too, demonstrating more accurate visual memory with higher VVIQ scores (Beran et al., 2023). Yet, contrary to expectations, our findings do not provide experimental evidence for a protective effect against verbal false memory generation in aphantasia.

The relatively large sample size compared to other published experiments involving aphantasics and the stricter $\leq$ 23/80 VVIQ criterion applied to identify aphantasic participants (Zeman, 2020) add to the reliability and validity of our experimental null findings. In fact, 77 % of the aphantasic participants in our sample had a score of 16 signifying no visual imagery at all, versus the median score of 45 in the control group. Whilst it remains the most commonly used tool to detect aphantasia, there are some inherent limitations associated with the reliance on the VVIQ as the only measure to establish group membership, especially considering the inconsistent cutoff scores applied across studies (e.g. $\leq$ 25 in Bainbridge et al., 2021; e.g. $\leq$ 32 in Dawes et al., 2020). It will be important for future research to employ more refined techniques to identify aphantasia in line with recent evidence derived from cluster analyses suggesting that it is a heterogeneous condition broadly described in two subtypes; those experiencing a selective absence of visual imagery (visual aphantasia) and those experiencing a lack of mental imagery in any sensory modality (multisensory aphantasia) (Dawes et al., 2024). For example, King et al. (2024) has implemented a design where both the VVIQ and the Psi-Q (Plymouth Sensory Imagery

Questionnaire; Andrade et al., 2014) were included in a sample of autistic and non-autistic adults to ascertain levels of aphantasia in different sensory modalities. These different manifestations of aphantasia, which were not considered in our sample, are likely to have a differential effect on various memory correlates including verbal veridical and false memory. Therefore, it will be essential to treat these subgroups separately in future work.

In conclusion, the experimental findings reported here provide no convincing evidence for reduced verbal memory capacity or reduced sensitivity to verbal false memory generation in aphantasia adding to the body of literature that failed to identify differences in cognition as the putative consequence of impoverished visual imagery (e.g., Siena & Simons, 2024; Keogh et al., 2021; Pounder et al., 2022). Such results call into question the universality of established theories within the mental imagery-memory literature and invite further research to build on these findings with the adoption of more sensitive measures in the context of sophisticated designs.

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CRediT authorship contribution statement

Kata Pauly-Takacs: Writing – review & editing, Writing – original draft, Visualization, Validation, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Saeed Younus:** Writing – original draft, Software, Project administration, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Natasha Sigala:** Writing – review & editing. **Gaby Pfeifer:** Writing – review & editing, Supervision, Resources, Methodology, Investigation, Data curation, Conceptualization.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.concog.2025.103888.

Data availability

Data will be made available on request.

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