Spared spatial imagery solves the puzzle of aphantasia

Ian Phillips[1,*]

The puzzle of aphantasia concerns how individuals reporting no visual imagery perform more-or-less normally on tasks presumed to depend on it [1]. In his splendid review, Zeman [2] canvasses four "cognitive explanations": (i) differences in description; (ii) "faulty introspection"; (iii) "unconscious or 'sub-personal' imagery"; and (iv) total lack of imagery. Difficulties beset all four. To make progress, we must recognize that imagery is a complex and multi-dimensional capacity and that aphantasia typically reflects partial imagery loss with selective sparing. Specifically, I propose that aphantasia commonly involves a lack of visual-object imagery (explaining subjective reports and objective correlates) but selectively spared spatial imagery (explaining preserved task performance) [3,4].

As Zeman argues, proposals that aphantasics' reports reflect differences in description or faulty introspection are confounded by "objective correlates": absence of imagery-based priming in binocular rivalry, lack of pupillary light responses to imagined bright stimuli [5], and flat-line galvanic skin responses when reading frightening stories [6]. At the same time, neural and behavioural evidence strongly suggests that imagistic representations are sometimes functional in aphantasia, ruling out total lack of imagery accounts. This leaves unconscious imagery. However, Zeman does not recognize that such accounts are also confounded by objective correlates. If (unconscious) imagery is present, why does it not prime rivalry, or elicit pupillary light and galvanic skin responses?

Some researchers have suggested that aphantasics may have failed to follow instructions or engage imagery [7]. This is unconvincing. In studies of galvanic skin responses,

trials were excluded in which subjects failed to demonstrate "proper reading and comprehension" of the frightening stories. So it remains a mystery why spontaneous imagery did not emerge [6]. Similarly, in studies of pupillary light responses, aphantasics showed a characteristic in-task correlation between pupil and stimulus set size, indicating that they were not "'refusing' to actively participate … due to … a belief that they are unable to imagine" [5]. Aphantasics also do voluntarily form images in other tasks despite lack of incentives [8].

The clue to solving the puzzle of aphantasia lies in a critical distinction drawn in both behavioural and neuropsychological literatures between visual-object and spatial imagery [9] (Box. 1). With this distinction in hand, we can understand aphantasia as often involving a lack of visual-object imagery but selective sparing of spatial imagery.

Lack of visual-object imagery explains objective correlates of aphantasia. Absence of priming in binocular rivalry can be explained by an inability to imagine colour given the coloured stimuli used. Absence of an imagery-based pupillary light response can be explained by a lack of brightness imagery. And flat-line galvanic skin responses to frightening stories can be explained by a lack of vivid visual-object imagery.

Spared spatial imagery explains preserved task performance since standard imagery tasks welcome spatial strategies. Consider, for instance, the Spatial Span, Mental Rotation and One Touch Stockings of Cambridge tasks from [1]. Equally, consider visual working memory tasks in which, say, the orientation of a Gabor or grating must be held in mind through a delay. Here both abstract spatial and sensorimotor strategies are available—as indeed reported by aphantasics themselves [10]. Some tasks at which aphantasics succeed may appear to implicate visual-object (e.g., colour) imagery, such as the Battérie Imagination-Perception object-comparison tasks in [11]. But here aphantasics' success plausibly reflects a combination of

spatial imagery and semantic strategies. Semantic strategies are quite consistent with high-level perceptual regions being activated as this happens in retrieving perceptual knowledge [12].

How has spared spatial imagery been missed in aphantasia? Aphantasia is ubiquitously identified using Marks' Vividness of Visual Imagery Questionnaire (VVIQ) in which subjects must visualize a scene (e.g., the rising sun) and compare the vividness of their imagery to normal vision on a 5-point scale. An aphantasic who only enjoys haptic or kinaesthetic imagery will evidently give the lowest ratings. As will an aphantasic who only enjoys amodal spatial imagery, since this will be no more like normal vision than touch. Finally, even an aphantasic who does enjoy distinctively visual spatial imagery may not rate this even as "2: Dim and vague image," insofar as their experience lacks the usual vestments of vision: brightness, colour, contrast, perspectival shape, visual texture etc. On the other hand, as Zeman notes, when spatial imagery is specifically probed in relevant items of the Object and Spatial Imagery Questionnaire, aphantasics score equal to controls.

I have focused on spared spatial imagery. But some individuals likely have spatial imagery deficits but spared visual-object imagery [3]. Indeed, as our understanding of individual variation in imagery deepens, we should expect to find a complex landscape of sparing and impairment—just as we find with perception. Moreover, again as with perception, we should remember that apparently puzzling dissociations of performance and awareness in imagery may simply reflect selective sparing which goes unreported when inappropriate or insufficiently sensitive measures of awareness are used.

Declaration of Interests

The author declares no competing interests.

[1] Department of Philosophy, and Department Psychological and Brain Sciences, Johns Hopkins University, Baltimore, MD 21218, United States of America

[*] Correspondence: ianbphillips@jhu.edu (I. B. Phillips)

Box. 1: Visual-Object Versus Spatial Imagery

Behavioural and neuropsychological work highlights a critical distinction between visual-object and spatial imagery [9].

Visual-object imagery refers to characteristically rich, detailed imagery of objects and their features as distinctively presented in visual experience. Examples include colour, contrast and brightness imagery (e.g., a bright silver moon against the night sky), since such features are necessarily presented visually, but also imagery of features presented in a distinctively visual manner, for instance, glossiness perceived through highlights and reflections, or shape perceived from a distinctively visual perspective.

Spatial imagery refers to characteristically abstracted or schematic imagery of spatial features available through multiple modalities. Examples include amodal imagery of a location, direction or spatial relation, as presentable either in sight, touch or audition, or amodal imagery of intrinsic shape, as presentable either in sight or touch. In resolving the puzzle of aphantasia by appeal to spared spatial imagery, we should also be open to the possibility of spared modality-specific spatial imagery in non-visual senses (e.g., haptic, proprioceptive, and motor imagery—on which a large literature exists, yet is often neglected by visually-focused aphantasia researchers) and/or sparing of visually-specific spatial imagery which is sufficiently abstract and schematic to be unreported in relation to VVIQ items.

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