**Supplementary Material**

Quantifying Aphantasia through drawing: Those without visual imagery show deficits in object but not spatial memory

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S1. Age-matched Subsampled Analyses

**Methods**

In order to ensure any results we observed in the main study were not due to differences in age between the participants with aphantasia (M=41.88 years, SD=13.88, Range=18 to 74) and control participants (M=32.12 years, SD=15.26, Range=18 to 75), we also conducted all analyses with a subsampled set of participants in which both groups were matched for age. The subsample was created by identifying pairs of participants in the two groups who were the same age or one year apart. If there was more than one possible pair, then the participant was selected randomly (e.g., there was only one 18-year old aphantasic individual, but two 18-year old controls, so the corresponding control participant was determined at random). This results in two groups with nearly identical distributions of age. The subsample consisted of 34 aphantasic participants (M=37.18 years, SD=15.25, Range=18 to 74) and 34 control participants (M=37.53 years, SD=15.47, Range=18 to 75), with no significant difference in age (*t*(66)=0.09, *p*=0.925). Note here that the control group is now slightly older than the aphantasic group on average, so any effects related to age should disappear or reverse. The results from all analyses are reported below in the same order as the analyses in the main manuscript.

**Results**

*Comparison of Survey Results*

Controls scored significantly higher on the OSIQ than aphantasic participants (control: M=89.09, SD=10.81; aphantasic: 62.91, SD=10.24; *t*(62)=9.95, *p*=1.83 × 10-14). There was a significant correlation between VVIQ score and OSIQ score for control participants (*ρ*=0.61, *p*=2.11 × 10-4), but only marginally for aphantasic participants (*ρ*=0.34, *p*=0.059). When broken down by OSIQ subscale, controls had significantly higher scores for object imagery questions (*t*(62)=14.75, *p*=5.96 × 10-22), but not spatial imagery questions (*t*(62)=0.22, *p*=0.828). A 2-way ANOVA (participant group × subscale) revealed a main effect of participant group (*F*(1,124)=87.28, *p*=4.44 × 10-16), subscale (*F*(1,124)=22.13, *p*=6.67 × 10-6), and a significant interaction (*F*(1,124)=93.64, *p*=1.11 × 10-16), confirming a difference in self-reported ratings for object imagery and spatial imagery respectively. Aphantasic and control participants showed no significant difference in their ratings of their own artistic abilities (aphantasic: M=2.38, SD=1.33; control: M=2.71, SD=0.94; non-parametric Wilcoxon rank sum test: *Z*=1.17, *p*=0.242). Aphantasic and control participants showed no significant differences in performance on the recognition task in terms of hit rate (aphantasic: M=0.96, SD=0.15; control: M=0.94, SD=0.13; *Z*=0.72, *p*=0.469) or false alarm rate (aphantasic: M=0, SD=0; control: M=0.04, SD=0.16; *Z*=1.11, *p*=0.269).

In sum, no statistics with the subsample showed differences in significance or direction compared to the full set of data.

*Comparison of Object Detail*

There was no significant difference between groups in number of drawings made (aphantasia: M=2.91, SD=0.29; control: M=2.88, SD=0.33; *Z*=0.38, *p*=0.701). A 2-way ANOVA of participant group (aphantasic / control) × drawing type (memory / perception drawing, repeated measure) looking at number of objects drawn per image showed no significant overall effect of participant group (*F*(1,130)=0.02, *p*=0.887), but a significant effect of drawing type (*F*(1,130)=298.88, *p*~0), and no significant statistical interaction (*F*(1,130)=3.58, *p*=0.063). Post-hoc independent t-tests show that aphantasic individuals drew significantly fewer objects than controls when drawing from memory (aphantasic: M=4.80, SD=2.36; control: M=6.41, SD=3.01; *t*(65)=2.43, *p*=0.018). There was no significant difference in number of objects drawn from perception (aphantasic: M=19.57, SD=8.01; control: M=18.26, SD=6.01; *t*(65)=0.76, *p*=0.452). Looking at number of objects drawn from memory normalized by the number drawn from perception, aphantasic participants drew a significantly smaller proportion of objects (aphantasic: M=0.246, SD=0.153; control: M=0.356, SD=0.142; *Z*=3.48, *p*=4.94 × 10-4). There was a significant correlation between number of objects drawn from memory and perception for aphantasic participants (*r*=0.61, *p*=6.09 × 10-4), and marginally for control participants (*r*=0.34, *p*=0.051). There was no longer a significant correlation between proportion of objects drawn from memory and OSIQ object score across participants (*r*=0.22, *p*=0.080).

Aphantasic and control participants did not show differences in the number of drawings containing color drawn from memory (aphantasic: 25.3%; control: 32.5%; *χ2*=1.14, *p*=0.286) or from perception (aphantasic: 48.4%; control: 44.4%; *χ2*=0.27, *p*=0.603). Control participants spent significantly longer time on their memory drawings than aphantasic participants (control: M=114.38 s per image, SD=70.94; aphantasic: 68.60 s, SD=53.76; *t*(66)=3.00, *p*=0.004). There was no significant difference for perception drawings (control: 316.57 s, SD=409.66; aphantasic: 260.15 s, SD=318.15; *t*(64)=0.63; *p*=0.533). When normalizing drawing time by number of objects, there was no difference between groups for memory drawings (*Z*=1.48, *p*=0.139) or perception drawings (*Z*=0.21, *p*=0.834). There was no difference in number of object descriptors between groups for memory drawings (*t*(66)=1.05, *p*=0.297) or perception drawings (*t*(65)=1.01, *p*=0.317).

The subsample confirmed that aphantasic individuals recall significantly fewer objects than those with typical imagery and spend less time drawing from memory. However, for this subsample there is no longer a significant difference in usage of color or time spent per object.

*Comparison of Symbolic Information*

Significantly more memory drawings by aphantasic participants contained text than those by controls (aphantasic: 30.3%; control: 15.0%; *χ2*=5.77, *p*=0.016). For this subsample, aphantasic participants also included significantly more text for their perceptual drawings (aphantasic: 5.4%; control: 0%; *χ2*=4.48, *p*=0.034). There was no significant difference in number of objects drawn between drawings with text and those without, for any condition (aphantasic memory drawings: *t*(97) = 1.10, *p*=0.275; aphantasic perception drawings: *t*(91) = 0.21, *p*=0.836; control memory drawings: *t*(96) = 1.00, *p*=0.322; no control perception drawings contained text).

The subsample confirmed that aphantasic individuals include more text in their drawings, and this is not as a result of a trade-off with resources not spent on object memory.

*Comparison of Spatial Accuracy*

For memory drawings, there was no significant difference between groups in object location error in the x-direction (aphantasic: M=64.04, SD=27.28; control: M=58.26, SD=24.85; *t*(66)=0.91, *p*=0.365), nor the y-direction (aphantasic: M=70.16, SD=31.13; control: M=73.25, SD=27.50; *t*(66)=0.43, *p*=0.666). There was also no difference in object size error for ellipse width (aphantasic: M=23.12, SD=11.82; control: M=25.29, SD=14.31; *t*(66)=0.68, *p*=0.498), although there was a marginally significant difference in height in which aphantasic participants tend to draw objects as taller (aphantasic: M=29.71, SD=15.76; controls: 23.12, SD=10.58; *t*(66)=2.03, *p*=0.047). For perception drawings, there were no differences in object X-location (aphantasic: M=33.47, SD=17.77; control: M=34.60, SD=16.95; *t*(65)=1.82, *p*=0.073) and height (aphantasic: M=20.69, SD=9.25; control: M=21.82, SD=7.16; *t*(65)=0.56, *p*=0.576). There were marginal differences in object Y-location (aphantasic: M=32.16, SD=19.84; control: M=41.95, SD=20.21; *t*(65)=2.00, *p*=0.050) and width (aphantasic: M=22.79, SD=8.19; control: M=26.64, SD=7.93; *t*(65)=1.96, *p*=0.055), where controls showed more spatial errors.

This subsample shows that aphantasic individuals show no differences from controls in accuracy of their spatial memory, with higher accuracy than controls for perceptual drawing.

*Comparison of Errors*

Within this subsample, significantly more memory drawings by controls contained false objects than drawings by aphantasic participants (control: 7 drawings, aphantasic: 1 drawing; *χ2*=4.75, *p*=0.029). When looking at total proportion of objects drawn that were false objects, this difference was not significant (*χ2*=3.30, *p*=0.069). Significantly more memory drawings by control participants had editing than those by aphantasic participants (aphantasic: 29.3%; control: 43.8%; *χ2*=4.03, *p*=0.045). There was no difference in editing between groups for perception drawings (aphantasic: 37.6%; control: 43.2%; *χ2*=0.56, *p*=0.454).

The subsample shows that aphantasic individuals make fewer errors from memory than controls.