A Case of Congenital Aphantasia: Is Imagery Apparent in Visual Brain Areas?

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INTRODUCTION

BACKGROUND

- Visual imagery involves recreating experiences in the absence of stimuli.
- A person living with **aphantasia** is unable to create images in their mind's eye (Zeman et al., 2015).
- The biological foundation of the mind's eye is not fully understood.
- fMRI studies have shown that the early processing areas of the visual cortex are activated during mental imagery tasks
- (Ishai et al., 2002).

QUESTION

- **Is there neural evidence for imagery in aphantasia?**

INVESTIGATION

- The experiment was based on past findings that imagining a stimulus before it is presented, influences ensuing stimulus-locked event-related potentials (ERPs; Farah et al. 1988).

METHODS

PARTICIPANT:

- A 25 year old male with congenital aphantasia
- Normal visual acuity and contrast sensitivity (Hamilton - Veale)
- VVIQ: 4.9/5

APPARATUS & MATERIALS:

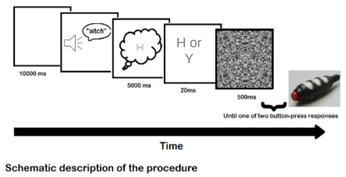
- IWORX EEG (Labscribe) system
- Electro-cap with 19-electrodes
- IWORX EM-220 Event Marker
- VVIQ (Marks, 1973)
- HP-Probook & Dell 16" monitor for stimulus presentation

STIMULI:

- Supra-threshold audio of letter **'H'**
- 1 deg x 1 deg low contrast grey '**H' or 'Y'**

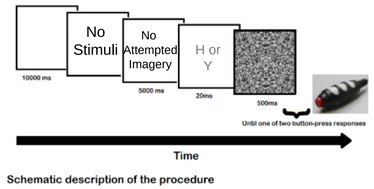
PROCEDURE:

- 3 sessions of 100 trials per session for two conditions
- **Condition 1: Attempted Imagery**



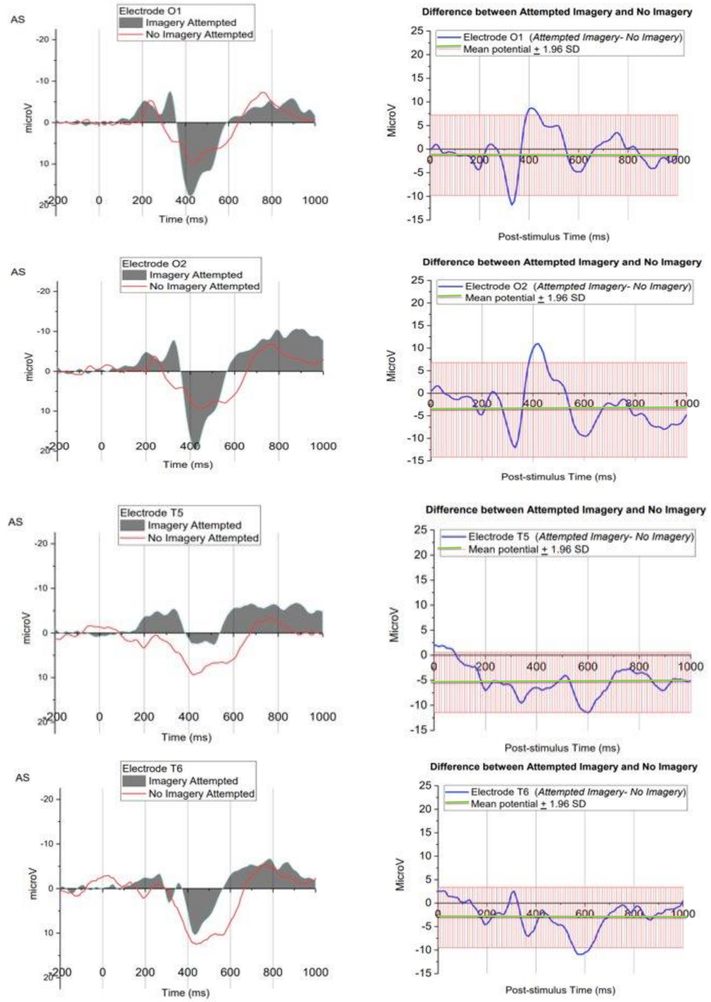
Schematic description of the procedure

- **Condition 2: No Imagery**



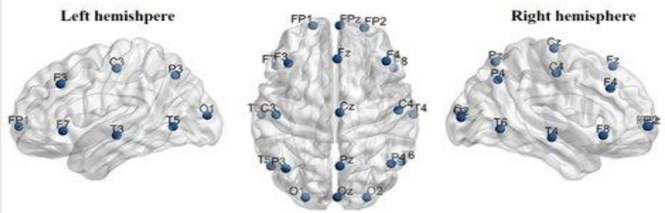
Schematic description of the procedure

RESULTS *(Target "H" with and without preceding attempted imagery)*



RESULTS CONTINUED

Electrode positions and general brain area monitored



Adapted from Rojas et al. (Frontiers in Neuroscience, 2018)

- There were differences in ERP profiles between the Attempted Imagery and No Imagery conditions.
- ERP differences were not always close to zero, and there were periods of replicated outlying differences (e.g. at P300 in the Occipital lobes, and N700 in the Temporal lobes).

DISCUSSION

- P300 and N700 represent working memory and conscious stimulus recognition processing (Bender et al., 2008).
  - Earlier P300 with **Imagery** in occipital lobes (see around 400ms)
  - Earlier N700 with **Imagery** in temporal lobes (see around 600ms).
- There may be some evidence of unconscious imagery priming in this case of aphantasia.
- A comprehensive account of visual image generation in aphantasia requires more experiments.

REFERENCES

Bender, S., Oelkers-Ax, R., Hellwig, S., Resch, F., & Weisbrod, M. (2008). The topography of the scalp-recorded visual N700. *Clinical Neurophysiology.*

Farah et al. (1988). Electrophysiological evidence for a shared representational medium for visual images and percepts. *J. Experimental Psychology: General*.

Ishai, et al. (2002). Visual Imagery of Famous Faces: Effects of Memory and Attention Revealed by fMRI. *NeuroImage.*

Zeman, A., Dewar, M., & Della Sala, S.(2015). Lives without imagery Congential aphantasia. *Cortex.*

Acknowledgement: Madeleine Reardon was supported by a National Institute of Health REBUILD grant. We thank AS, our participant, for agreeing to be studied.