

Aphantasia and Phonological Processing During Reading

Michael A. Eskenazi, Morgan Lipkin, Lucas Surrency, & Olivia Tidd email: meskenazi@stetson.edu

Introduction

- Research Question:** Does the absence of inner speech disrupt phonological processing of words during silent reading?
- Background:** People with aphantasia lack the ability to experience internal representations of visual information. There are behavioral consequences of this abnormality as shown through a lack of a binocular rivalry effect in aphantasiacs (Keogh & Pearson, 2018). Aphantasia is not limited to a lack of visual experience, but can also include a lack of internal auditory representations.
- Current Study:** The purpose of the current study was to determine whether readers who lack internal auditory representations experience any disruption in two tasks that rely on auditory processing: masked homophone priming (Drieghe & Brysbaert, 2002) and the visual tongue twister effect (McCutchen & Perfetti, 1982).

Method

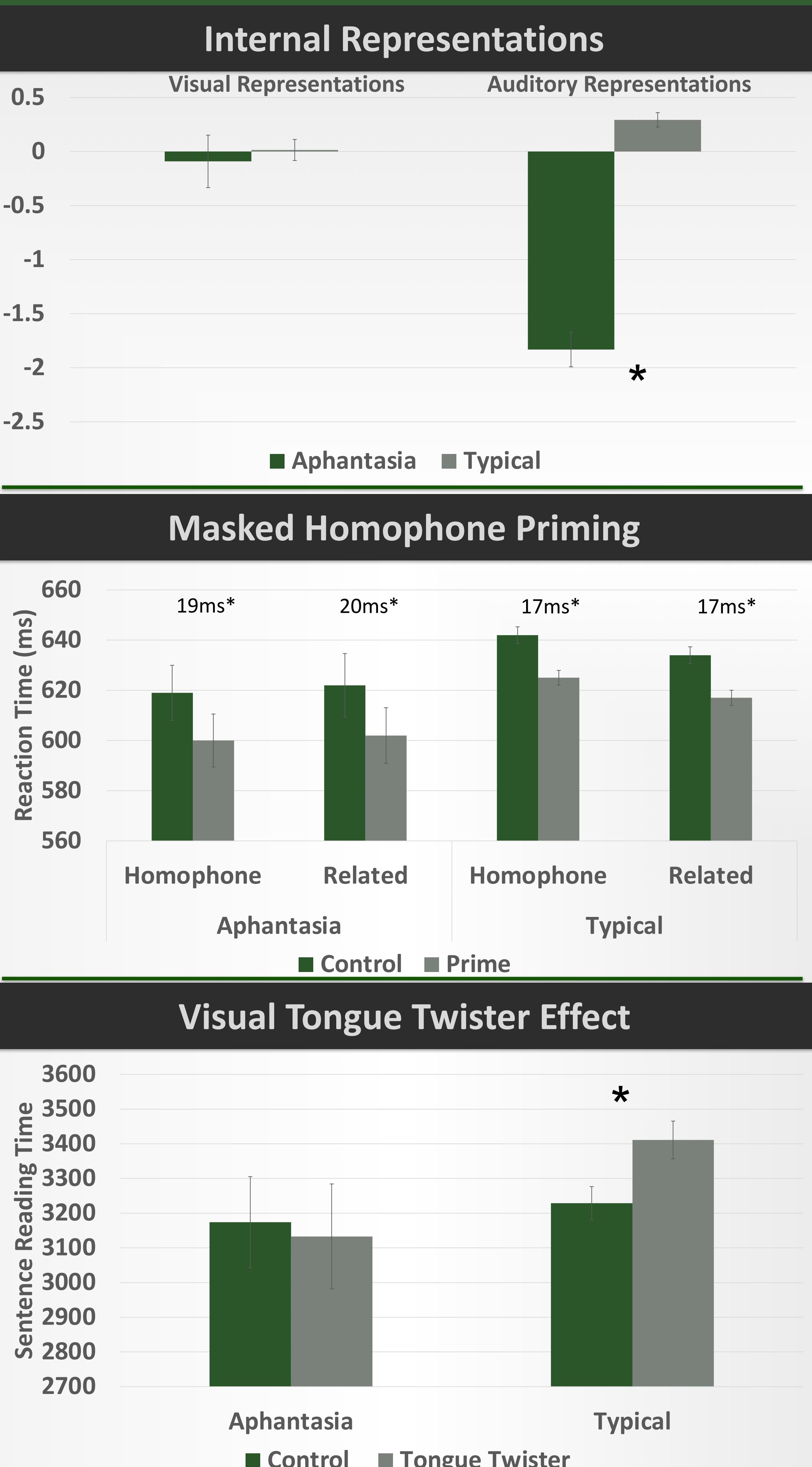
- Participants:** The sample included 107 typical participants and 17 participants with auditory aphantasia.
- Study 1: Masked Homophone Priming**
Participants completed a masked homophone priming lexical decision task with 80 target words preceded by either a semantically related word, a homophone of the semantically related word, or a matched control word for both prime types.

Related	Control	Homophone	Control	
#####	#####	#####	#####	Mask (500ms)
TALE	SINK	TAIL	BUSY	Prime (50ms)
story	story	story	story	Target

• Study 2: Visual Tongue Twister Task

Participants read 20 sentences that either had six repeated word-initial phonemes or zero repeated word-initial phonemes. Sentences were syntactically and semantically matched. Reading times were recorded and comprehension questions were asked after each sentence. A sample matched sentence pair is below:

His brother baked the banana bread before his birthday
His sister cooked the pumpkin bread after the reception



Results

Linear Mixed-Effects Analyses were conducted using R statistical software package lme4 with fixed effects of condition and participant type. Outcomes variables were reaction time or total sentence reading time in milliseconds.

- Internal Representation:** Standardized scores were created for the verbal and auditory subscales of the Internal Representations Questionnaire. Verbal aphantasiacs did not differ from typical participants on internal visual representations ($t(123) = .40, p = .69, d = .11$), but they differed greatly on internal auditory representations ($t(123) = 11.97, p < .001, d = 3.12$).
- Homophone Priming:** There was a significant priming effect such that participants responded to targets preceded by a prime faster than targets preceded by the prime's control, $\beta = .0094, SE = .0023, t = 4.03$. There was no interaction with prime type or aphantasia condition. Thus, homophone priming occurred in both types of participants and matched semantic priming.
- Visual Tongue Twister Effect:** There was a main effect of condition such that readers took longer to process tongue twisters than control sentences, $\beta = .0197, SE = .0056, t = 3.53$. There was also an interaction between condition and aphantasia such that typical participants demonstrated the typical effect, but aphantasia participants did not, $\beta = .0358, SE = .0122, t = 2.93$.

Conclusions

- Aphantasia Does Not Block Early Phonological Activation**
Despite lacking conscious awareness of internal representations, auditory aphantasiacs still activate phonological codes very early in lexical identification. Their homophone priming effect is the same as typical participants and the same as semantic priming. This finding suggests that early activation of phonological information is unrelated to conscious experience.

- Aphantasia Blocks the Visual Tongue Twister Effect**
In contrast, auditory aphantasiacs have no visual tongue twister effect. They respond as quickly to tongue twister sentences as they do to control sentences. Previous findings suggest that the VTTE is less related to lexical processing and more related to working memory and comprehension processes (McCutchen et al., 1991). Thus, the source of auditory aphantasia may be within working memory.