

Introduction

- In our study, subjects respond to information in natural, free-flowing speech (stories), spoken by multiple talkers.
- Manual responses are made to visually presented questions about what was just said (after 1 sec) in one of the stories.

Phonetic answers are taken straight from the text.

Semantic answers use synonyms to convey the meaning.

An example trial

The ongoing story says "...There was enough light to see the yard and the trees beyond it. It was breathtaking..."

(A) is a **Phonetic** answer

(A) is a **Semantic** answer

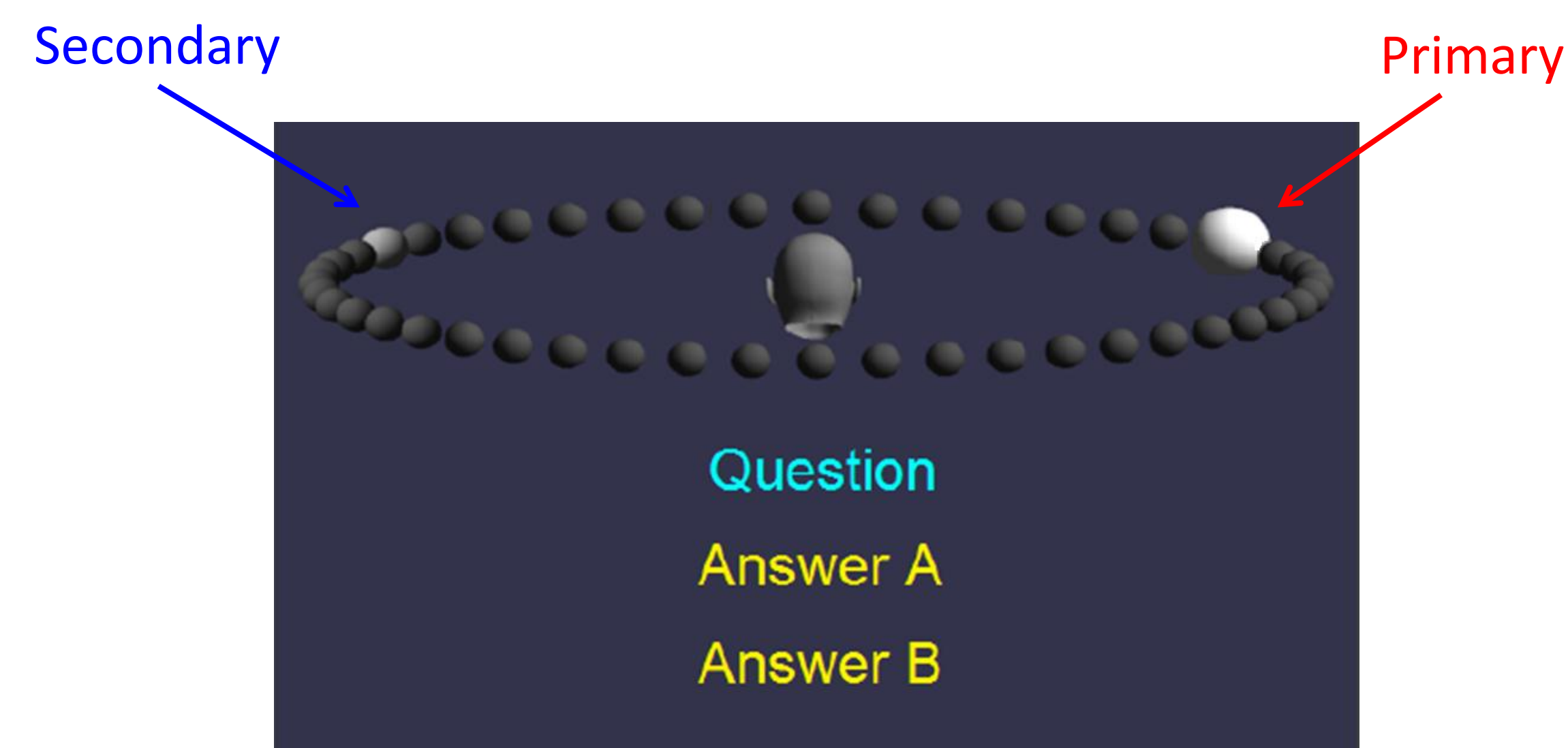
The woman love looking at

(A) The trees
(B) The lake

The woman love looking at

(A) The woods
(B) The lake

- In the **selective attention** paradigm, all questions come from a "primary" talker.
- In the **shared attention** paradigm, **P%** come from the "primary" while **(1 - P)%** come from a "secondary" talker.



This poster presents results from two new directions:

Study 1: Naturalistic listening experiments can involve more sources of uncertainty than traditional laboratory experiments (e.g., item effects, individual differences in attentional strategies, ...). To get a better handle on this issue, we are developing **Hierarchical Statistical Models** that allow better quantification of various sources of variance in a **shared attention** task with **semantic** processing.

Study 2: Our previous research has concentrated on normal-hearing listeners (see Hafter 2012). New data here examine the effects of **semantic** and **phonetic** processing on **selective attention** with hearing-impaired listeners.

Study I Experimental Details

16 young, normal-hearing subjects

All answers were based on **semantic** information

Subjects expected **70%** of questions from the primary talker and **30%** from secondary (**shared attention**)

Spatial separations between talkers were either 15° or 120°

Hierarchical Bayesian Model

sources of variability:

Inter-item effect:

- inherent difficulty of question i : μ_i

Inter-subject effect:

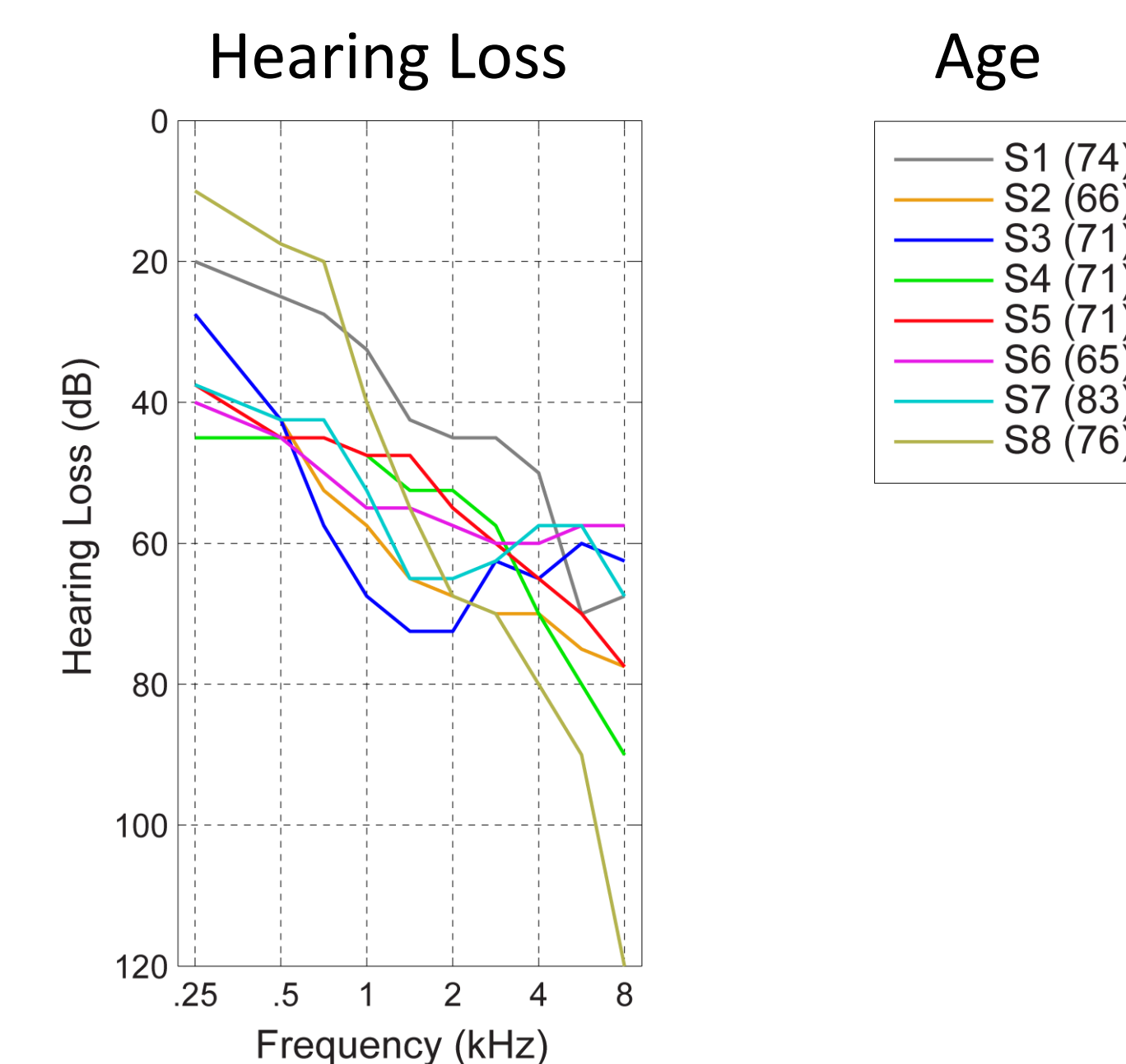
- inherent ability of subject j : μ_j
- proportion of attention devoted to primary by subject j : ω_j
- effect of relative talker separation (120° re: 15°) for subject j on understanding primary: μ_{dp}
on understanding secondary: μ_{ds}

output:

percentage of correct response: P_c

Study II Experimental Details

8 older subjects w/ symmetric hearing loss



Phonetic and **Semantic** answers tested in separate sessions

100% questions from the primary talker (**selective attention**)

15° spatial separation between talkers

Subjects fitted by Starkey HAs w/ all advanced features off

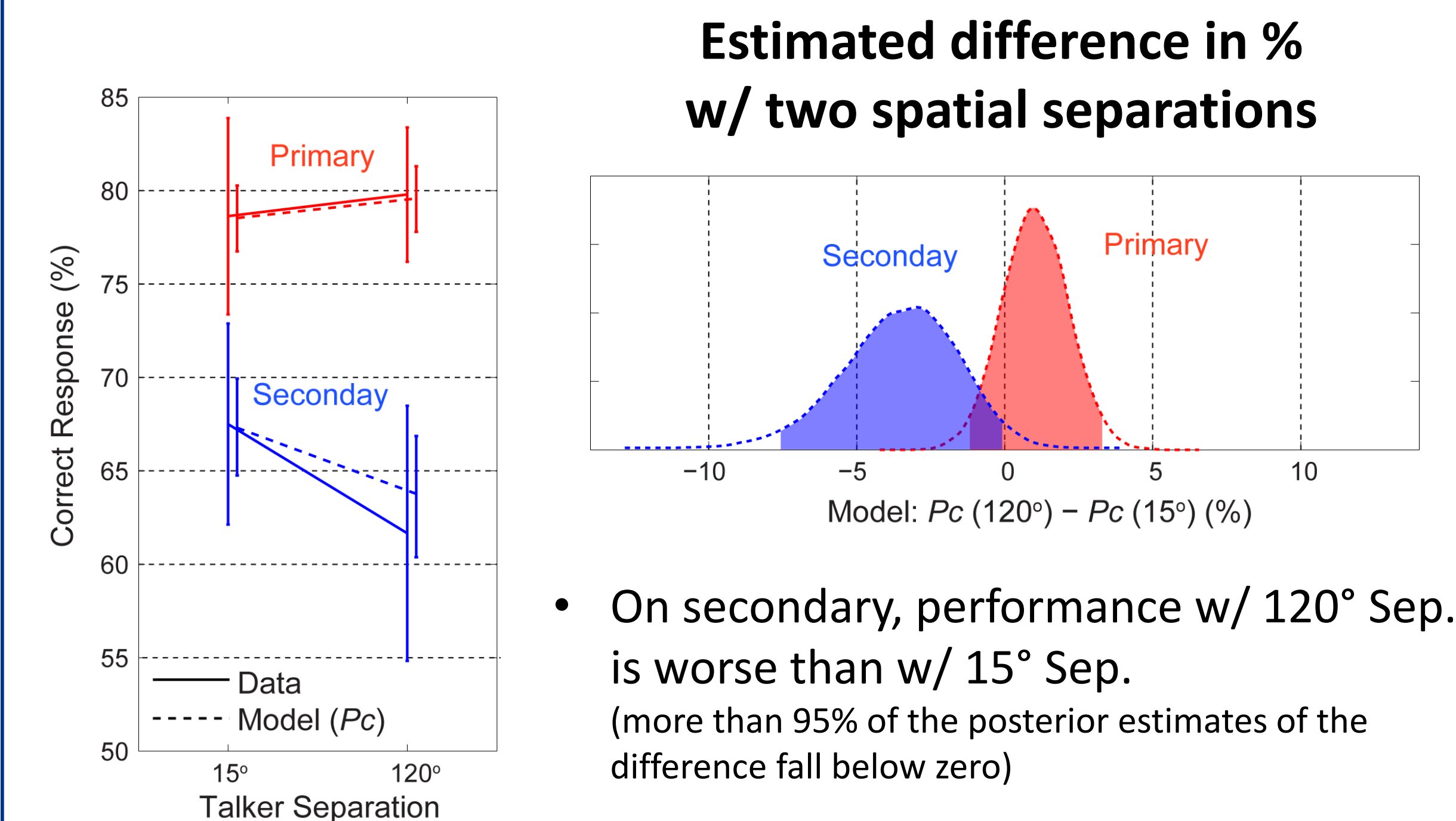
Linguistic/cognitive assessments included vocabulary, reading abilities, working memory and attention

Hafter E, Xia J and Kalluri S (2012). in *Basic Aspects of Hearing: Physiology and Perception*, 527-534

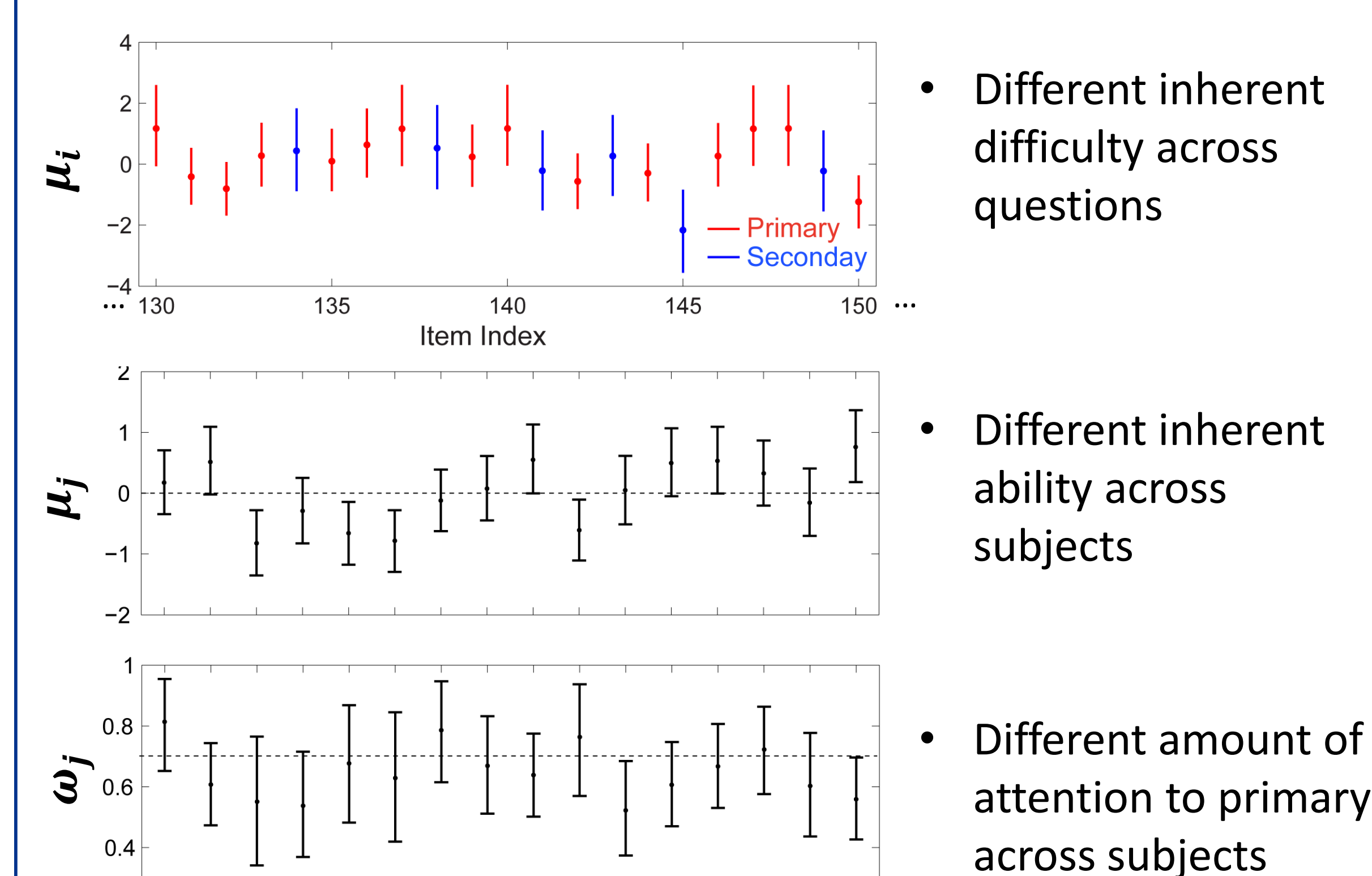
Lunner, T., & Sundewall-Thorén, E. (2007). *JAAA*, 18(7), 604–617.

Woods, W. S., Kalluri, S., Pentony, S., & Nooraei, N. (2013). *JASA*, 133(6), 4268–7428.

Study I Results



Estimated inter-item and inter-subject effects

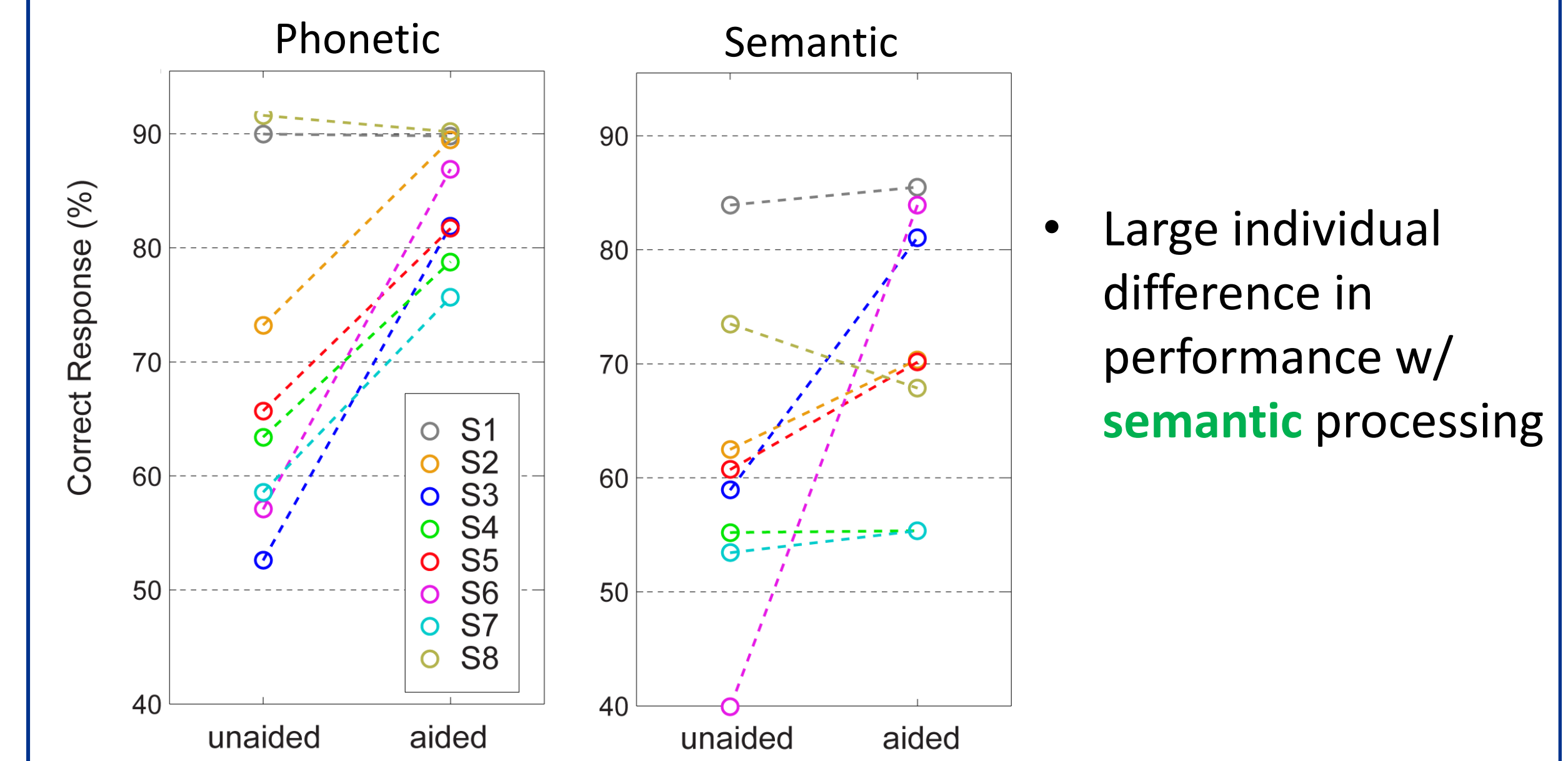


Study I Summary and Discussion

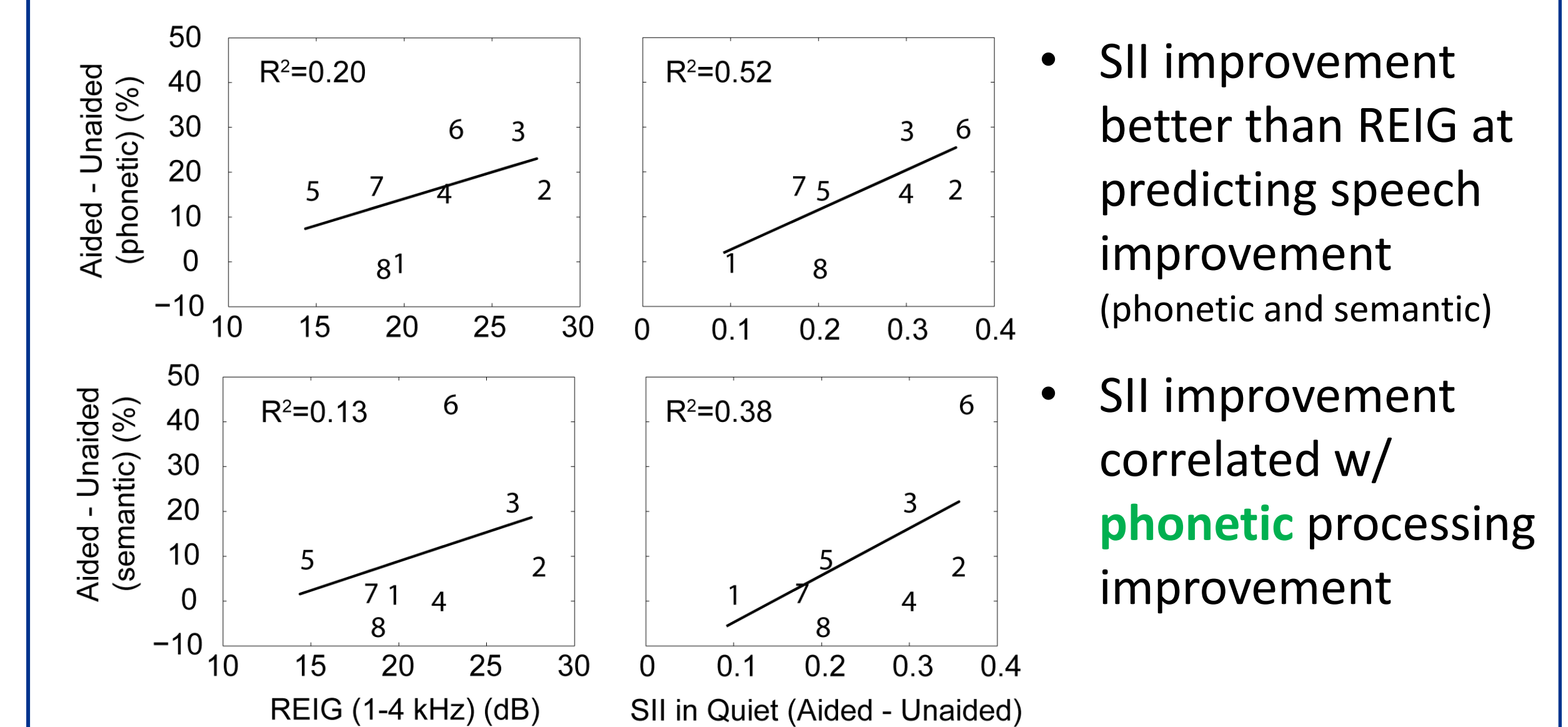
- One expects greater variance in performance for naturalistic experiments (e.g., items, subjects,...).
- The **Hierarchical Bayesian models** provide a principled way to take into account various sources of variance.
- Here, parsing out irrelevant variance components has led to clear delineation of an effect of spatial separation on semantic responses to a secondary talker.
- This result supports the idea of an inclusive spatial band that allows better monitoring of non-primary stimuli when they are located closer to the primary, opposite to the traditional spatial release from masking found when attention is to only one talker.

Study II Results

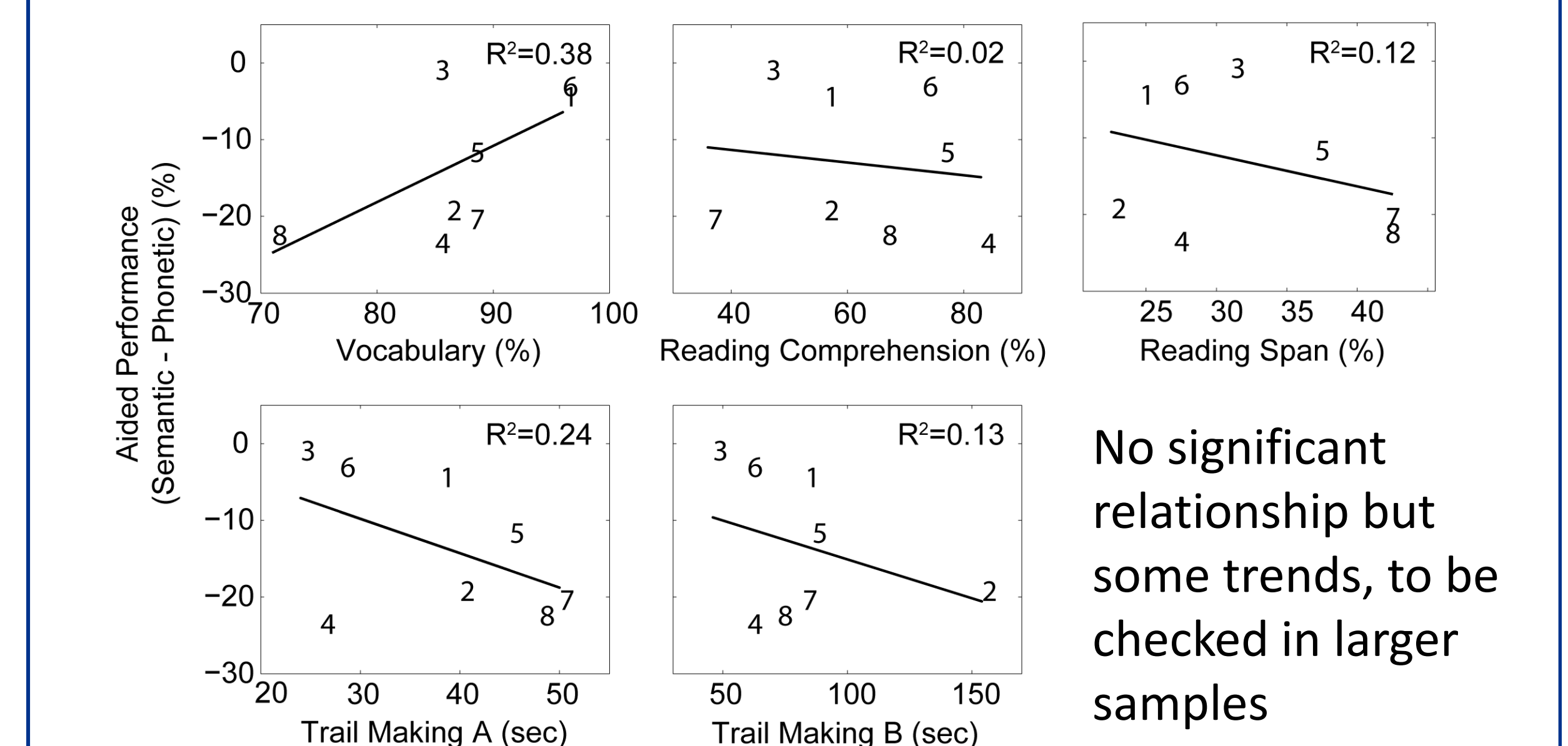
Aided and unaided performance



Correlation between audibility and performance



Correlation between cognitive ability and aided performance (e.g., Lunner 2007; Woods 2013)



Study II Summary and Discussion

- Audibility accounts for the HAs' benefits in recognizing target sound (**phonetic**) with one interferer; whereas speech understanding (**semantic**) in such scenario depends on both audibility and linguistic/cognitive abilities.
- A metric for measuring speech understanding offers another way to evaluate HAs or speech-training programs, which may be more predictive of users' satisfaction.