

## Introduction

- What happens to non-linguistic indexical information in the speech signal (e.g., speaker identity)?
  - Normalization view: Indexical information is discarded prelexically to contact an abstract representation (Pisoni, 1997; Salvata, Blumstein & Myers, 2012)
  - Episodic view: Indexical information is stored as part of a lexical representation (Chandrasekaran, Chan & Wong, 2011; Goldinger, 1998).
- Is information about a speaker's identity maintained in lexical representations?
- Given evidence that activating a target word partially activates phonological neighbors and semantic associates, **can indexical information also permeate the lexical-semantic network?**
- Given evidence that talker effects may be modulated by attention to talker (Theodore, Blumstein, & Luthra, 2015), **might attention play a role in whether speaker information can spread between representations?**

## Experiment 1: Methods

False Memory Task (Roediger, McDermott, Pisoni, & Gallo, 2004)

Study:

- Subjects heard lists of words, each list designed to evoke a false memory for an unstudied **critical intruder (CI)**.
- Each list was produced by a male or female speaker.

Test:

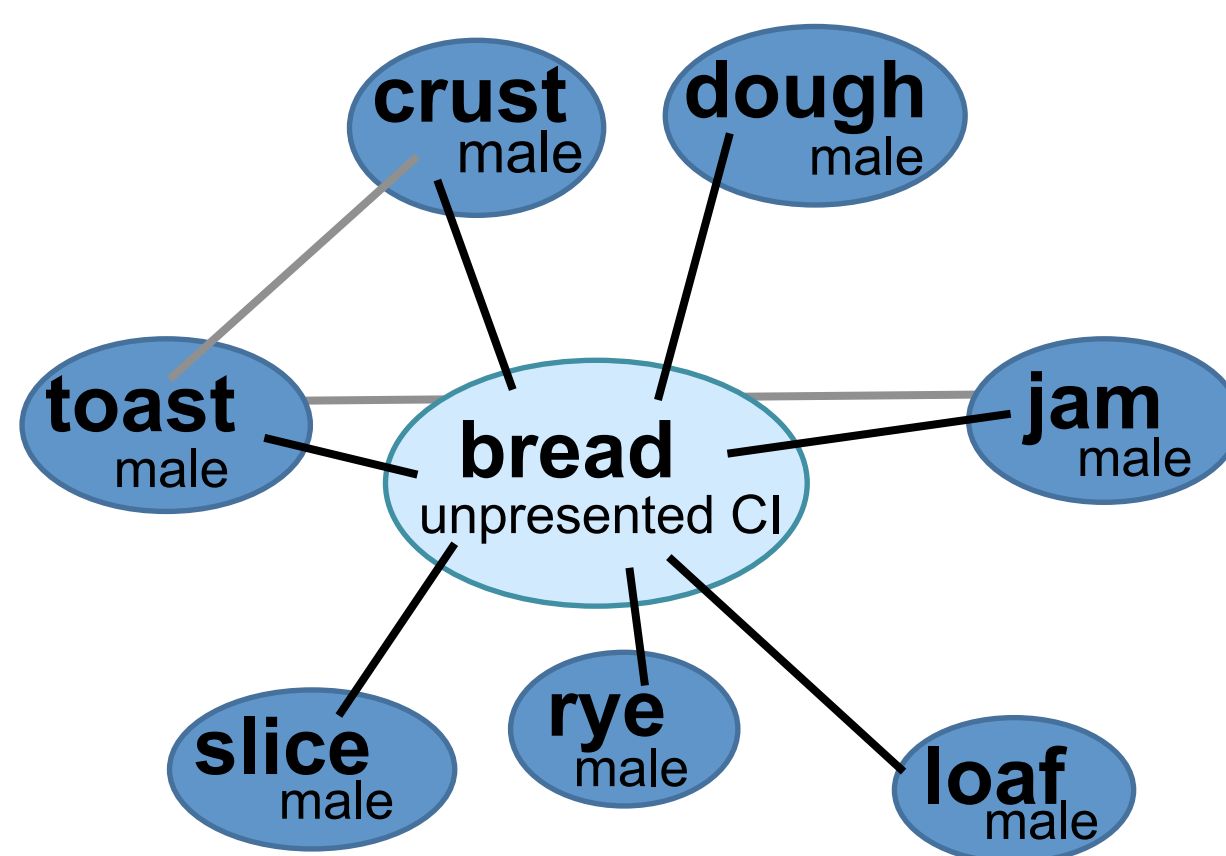
- Subjects received a recognition test of studied items, CIs and unstudied fillers.
- Studied items/CIs were produced by the **same/congruent talker** as encoding or by the **different/incongruent talker**.

Study:

Hear words in dark blue

Test:

"Did you hear...?"



crust<sub>male</sub> (studied, same talker)  
bread<sub>male</sub> (CI, same talker)

-OR-

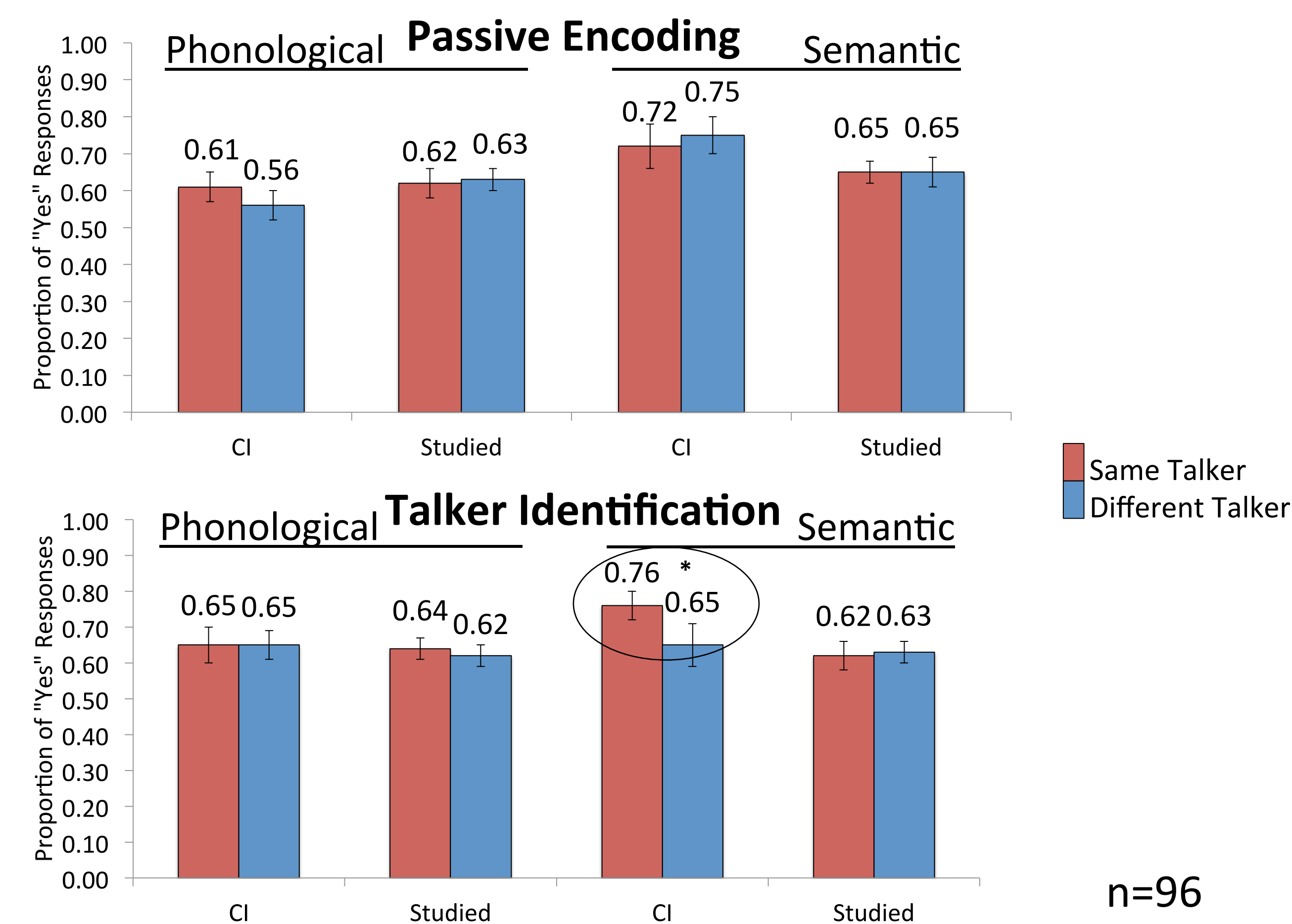
crust<sub>female</sub> (studied, different talker)  
bread<sub>female</sub> (CI, different talker)

Two factors were crossed and manipulated between subjects:

- Encoding – Subjects **identified the talker** of each word during study or **passively encoded** the lists.
- List Type – Studied items were either **semantic** associates of the CI (above) or **phonological** neighbors of the CI.

## Experiment 1: Results

- Subjects had false memories for CI words: CIs were recognized as old significantly more than were unstudied fillers (false alarm rates: 0.67, 0.22;  $p < 0.001$ )
- When subjects **attended to talker identity** during encoding, **congruent speaker information** boosted false recognition of **semantically associated CIs** (see figure, below).

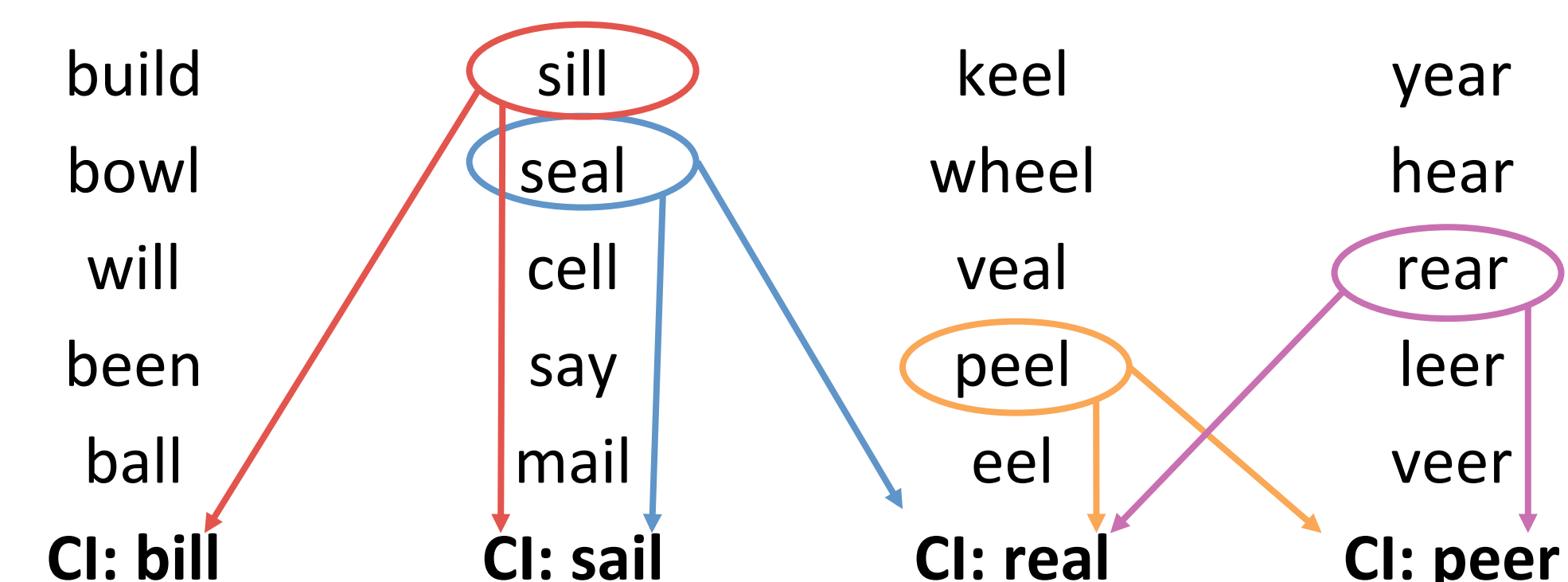


## Experiment 1: Discussion

- Speaker information can **permeate the lexical-semantic network**, boosting activation of semantically related words that **have not been studied**.
- If semantic analysis occurs after phonological analysis, why does speaker information have effects on the **semantic network** but **not on phonological neighbors**?

## Experiment 2: Methods

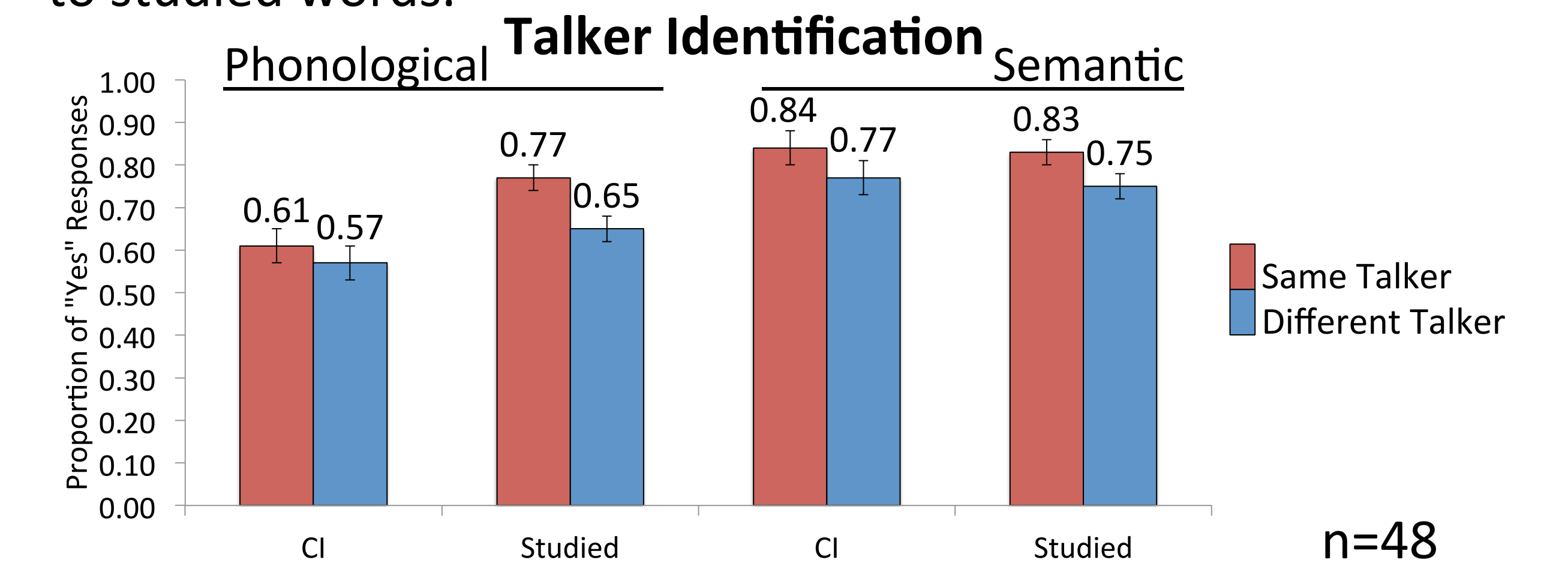
- Unlike the semantic stimuli, Expt. 1 **phonological** stimuli (Sommers & Lewis, 1999) shared many features between lists.



- To minimize between-list overlap, each phonological list in Expt. 2 had words with only one manner of articulation. One list contained only stop consonants, one only liquids/glides, one only fricatives and one only nasals.

## Experiment 2: Results

- Subjects had false memories for CI words (mean false alarm rates: 0.70 (CIs), 0.14 (filler);  $p < 0.001$ ).
- Results revealed a main effect of talker, such that **congruent speaker information** between study and test **boosted recognition**. This effect emerged for **studied** items and **unstudied CIs** that were **phonologically** or **semantically** related to studied words.



## Conclusions

- Indexical information (like speaker identity) can **spread through the lexical-semantic network**, contacting representations subjects have not heard but that are phonologically or semantically related to studied items.
- Results support models of spoken word recognition that **preserve non-linguistic information** in lexical representations and allow for an **influence of attention** on this processing (e.g., Goldinger & Azuma, 2003).

## References

- Chandrasekaran, B., Chan, A. H., & Wong, P. C. (2011). Neural processing of what and who information in speech. *Journal of Cognitive Neuroscience*, 23(10), 2690-2700.
- Goldinger, S. D. (1998). Echoes of echoes? An episodic theory of lexical access. *Psychological Review*, 105(2), 251-279.
- Goldinger, S. D. & Azuma, T. (2003). Puzzle-solving science: The quixotic quest for units in speech perception. *Journal of Phonetics*, 31, 305-320.
- Roediger, H. L., & McDermott, K. B. (1995). Creating false memories: Remembering words not presented in lists. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 21(4), 803-814.
- Roediger, H. L., McDermott, K. B., Pisoni, D. B. & Gallo, D. A. (2004). Illusory recollection of voices. *Memory*, 12(5), 586-602.
- Salvata, C., Blumstein, S. E., & Myers, E. B. (2012). Speaker invariance for phonetic information: an fMRI investigation. *Language and Cognitive Processes*, 27(2), 210-230.
- Sommers, M. S. & Lewis, B. P. (1999). Who really lives next door: Creating false memories with phonological neighbors. *Journal of Memory and Language*, 40, 83-108.
- Theodore, R. M., Blumstein, S. E., & Luthra, S. (2015). Attention modulates specificity effects in spoken word recognition: Challenges to the time-course hypothesis. *Attention, Perception, & Psychophysics*, 77(5), 1674-1684.
- Pisoni, D. B. (1997). Some thoughts on "normalization" in speech perception. In K. Johnson and J.W. Mullennix (Eds.), *Talker Variability in Speech Processing* (pp. 9-32). San Diego: Academic Press.

## Acknowledgements

This research was supported by NIH Grant DC00314. SL was supported by the Society of Royce Fellows at Brown University. NPF was supported by NSF Graduate Research Fellowship DGE 0228243 and a Graduate Fellowship from the Brown Institute for Brain Science at Brown University. Additional thanks are extended to Rachel M. Theodore and members of the Blumstein lab for valuable feedback throughout this project.