

# Variability in the input: The role of multiple talkers in a statistical language learning paradigm

Nicolette Noonan & Lisa Archibald | Department of Psychology, Western University

nnoonan3@uwo.ca



Western



## Introduction

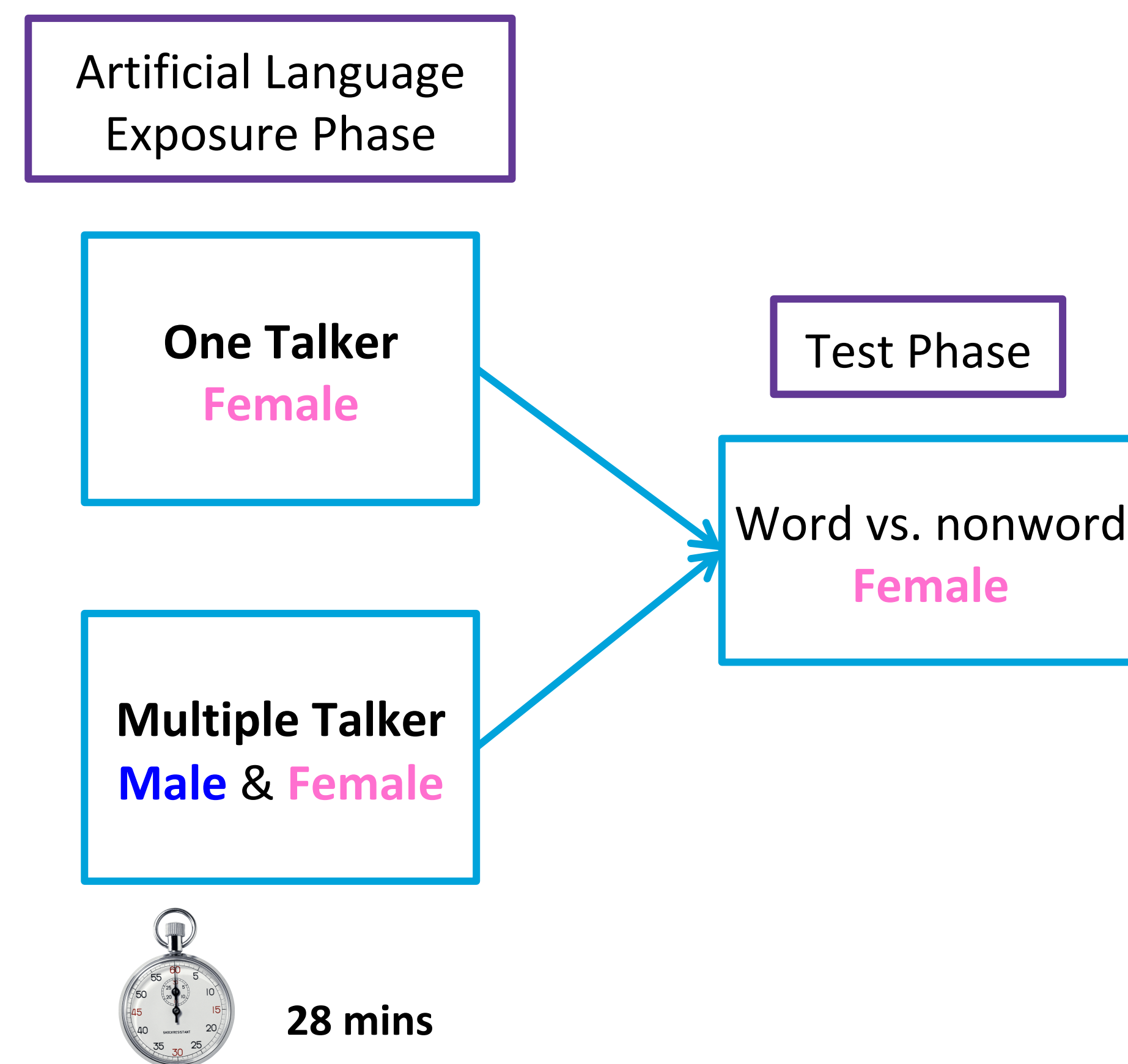
- Statistical learning refers to the *discovery of patterns in the input* (Reber, 1967).
- The learning of word boundaries can occur through an **implicit** computation of **transitional probabilities**, which are statistically predictive relationships between syllables (Saffran et al., 1996). This process has been widely demonstrated in previous research.
- Artificial language stimuli used in statistical language learning paradigms often use one voice or talker. Our goal was to investigate whether learning in this paradigm is affected by having multiple talkers of different genders.
- Our main question was whether adults encode representations of newly segmented words using **indexical** or **abstract conceptual** representations.
- An indexical representation would show **talker-specific advantages**, while an abstract conceptual representation would show **generalization** across speaker genders
- Actual language requires flexible categories because of **lack of invariance**, so forming abstract phonological representations would be adaptive for language acquisition.

## Method

### Participants

42 young adults  
English monolingual; normal hearing/vision

### Procedure



### Artificial Language Stimuli

- Six trisyllabic “words” generated from 12 CV syllables
- Unsegmented language stream: Only cue to word boundaries were the **transitional probabilities** between syllables

putibu **bu**pada pidadi **babu**pu dutaba **tu**tibu

**Within-word**  
frequency of /ba/./bu/  
frequency of /ba/ > **Between-word**  
frequency of /ba/./tu/  
frequency of /ba/

## Method cont'd

### Artificial Language Stimuli Recording

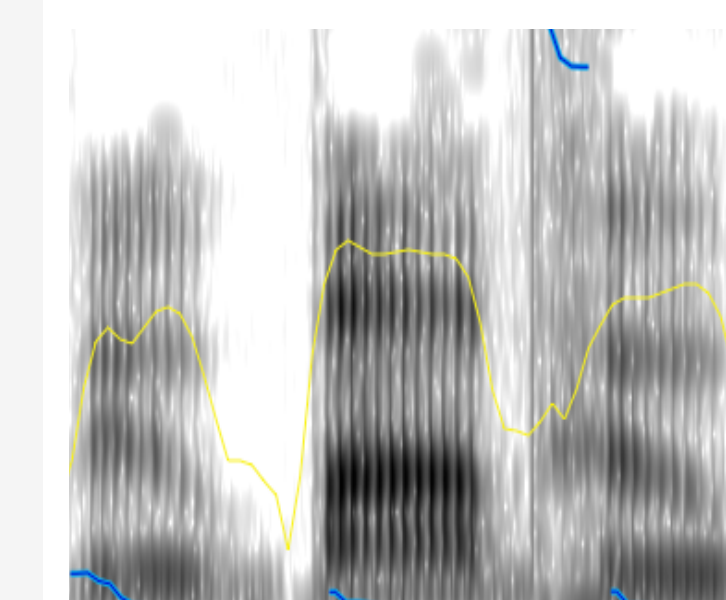
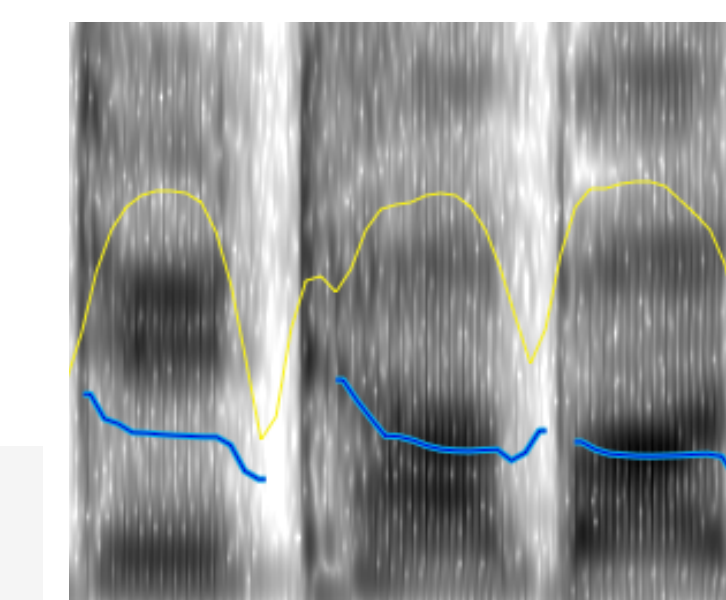
- **One talker:** Female voice only only
- **Multiple Talker:** Male and female voice alternating, 1 min each; total = 14 mins of each voice throughout
- All digitized at 44.1Hz

TABLE 1:

Talker	Mean Duration Ms (SD)	Mean Pitch Hz (SD)	Pitch Peak Hz
Female	0.562 (0.07)	<b>192.78</b> (11.13)	473.73
Male	0.618 (0.03)	<b>98.78</b> (14.84)	491.21

Acoustic analysis of words from the artificial language stimuli

Note: Bolded values are significantly different,  $p < .05$



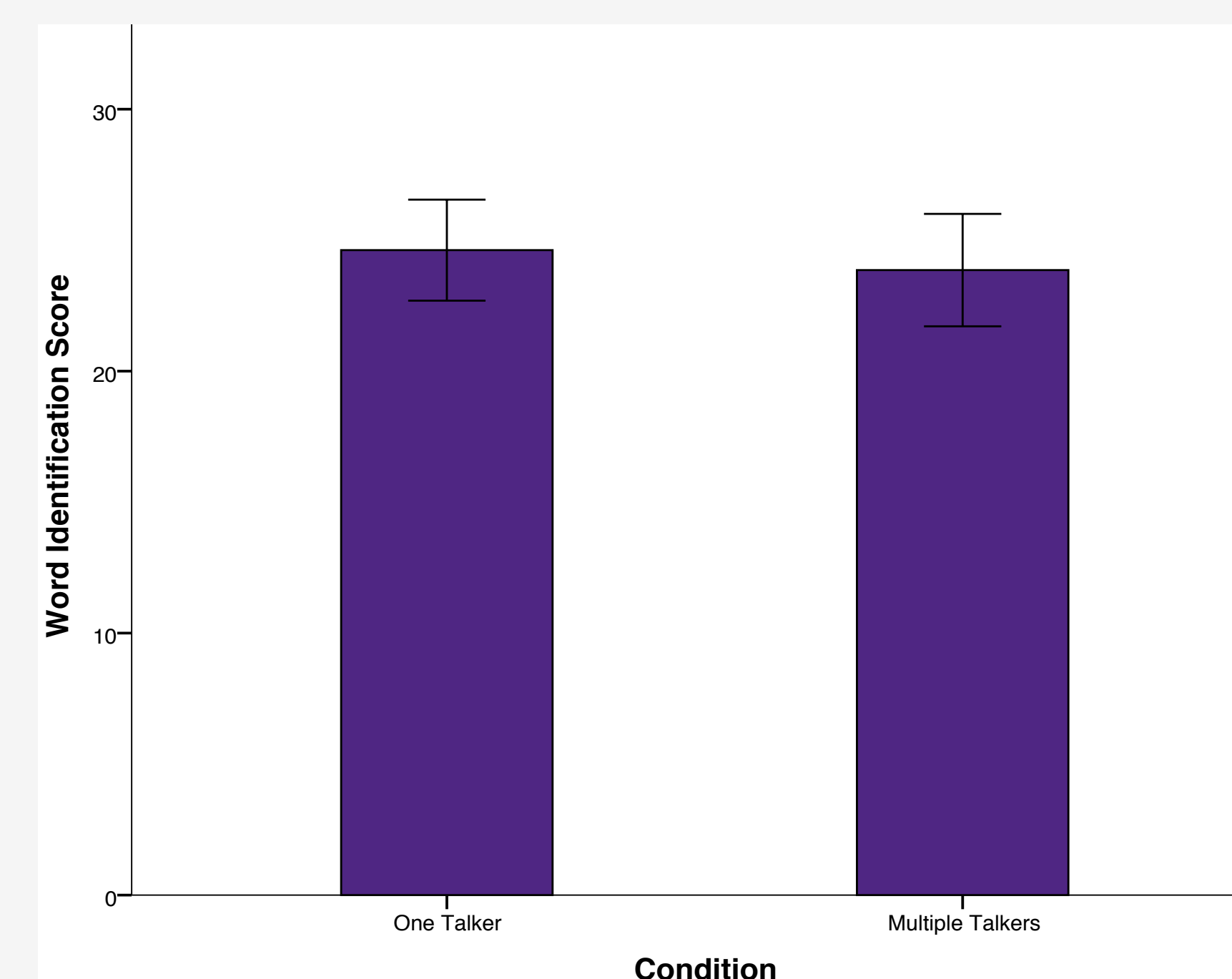
## Results

TABLE 2:

Word identification scores for single and multiple talker conditions

Word identification scores **did not differ** across conditions  
 $t(1, 41) = 0.551, p > .05$

Note:  $n = 21$ , each group; error bars represent confidence intervals around the means



## Conclusions

- Participants in either condition **did not differ** in their **word identification scores**
- Average performance in either condition was **statistically above chance**, demonstrating successful learning across conditions with sufficient exposure
- This finding runs contrary to previous work where words were better recognized when produced by the same talker (Craig & Krisner, 1974; Palmeri et al., 1993)
- However, some studies have shown talker specific characteristics do not influence recognition (Houston & Jusczyk, 2000; van Heugten & Johnson, 2012)
- Word segmentation may involve the formation of **abstract categorical representations**
- After a sufficient number of diverse words, a distinct category may be formed

## References

Craig, F. I. & Kirsner, K. (1974). The effect of speaker's voice on word recognition. *The Quarterly Journal of Experimental Psychology*, 26(2), 274-284; Houston D. M. & Jusczyk, P. W. (2000). The role of talker-specific information in word segmentation by infants. *Journal of Experimental Psychology: Human Perception and Performance*, 26(5), 1570.; Palmeri, T. J., Goldinger, S. D., & Pisoni, D. B. (1993). Episodic encoding of voice attributes and recognition memory for spoken words. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 19, 309-328.; Reber, A. S. (1967). Implicit learning of artificial grammars. *Journal of Verbal Learning and Verbal Behaviour*, 6(6), 855-863.; Saffran, J. R., Aslin, R. N., & Newport, E. L. (1996). Statistical learning by 8-month-old infants. *Science*, 274(5294), 1926-1928; van Heugten, M. & Johnson, E. K. (2012). Infants exposed to fluent natural speech succeed at cross-gender word recognition. *Journal of Speech, Language, and Hearing Research*, 55(2), 554-560.