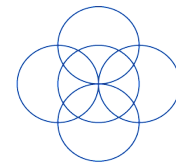# THE RELATIONSHIP BETWEEN LEXICAL-PHONETIC AND SOCIO-PHONETIC LANGUAGE DEVELOPMENT

DEPARTMENT OF
Communication Sciences and Disorders
UNIVERSITY OF WISCONSIN–MADISON

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WAISMAN CENTER

HOW DO CHILDREN LEARN TO TALK?

- Two forms of development
  - Lexical-phonetic development: producing and perceiving speech sounds
  - Socio-phonetic development: producing and perceiving phonetic properties associated with social groups
- Most research focuses on one form of development. This study looked at both.

LEXICAL-PHONETIC DEVELOPMENT

- Children learn speech sounds to understand and produce meaningful words and sentences
  - A child must be able to produce "s" and "sh" to distinguish words such as "sip" and "ship"
  - Later acquired sounds are generally more difficult to produce and perceive.

SOCIO-PHONETIC DEVELOPMENT

- Children learn to sound like their social group
  - Regional Dialect
  - Social Class
  - Gender

- Gender differences: due to anatomical structure as well as sociolinguistic learning
  - Boys' and girls' speech sound different as early as age 4, even though there is no difference in anatomical structure (Perry, Ohde, and Ashmead; 2001)

PURPOSE OF THIS STUDY

- Is there a relationship between lexical-phonetic and socio-phonetic development in typically developing children?
  - Lexical-phonetic development → acoustic and perceptual measures
  - Socio-phonetic development → perceptual measure

- Why does this matter?
  - Understanding children who have difficulty with lexical-phonetic, socio-phonetic development, or both

STIMULI

- Words that start with "s" and "sh" from a picture-prompted auditory word repetition task
  - Taken from recordings of 20 previous child participants in the Learning to Talk Research Lab
    - 10 boys and 10 girls
    - 3.5-4 years old

STIMULI

ACOUSTIC ANALYSIS

- Peak ERB of initial "s" and "sh" calculated
  - "s" is produced with a higher frequency→ higher peak ERB
  - "sh" is produced with a lower frequency→ lower peak ERB.

http://home.cc.umanitoba.ca/~krussll/phonetics/acoustic/img/voiceless-fricatives.png
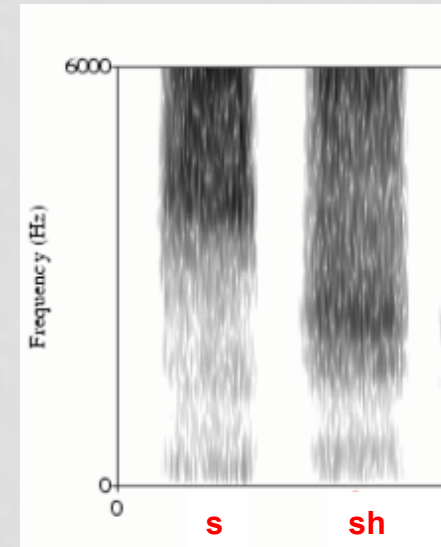
- Robustness of contrast measure:
  - Based on regression analysis for each child: how well could peak ERB classify all "s" and "sh" productions for that child?
  - Measure is "percent of productions correctly classified."

PARTICIPANTS FOR PERCEPTION STUDIES

- Participants: 43 undergraduate students currently enrolled at UW Madison
  - Tested on campus in quiet study rooms at a University library

- Rated stimuli for the perceptual measures
  - Lexical-phonetic measure: 20 females, 1 male
  - Socio-phonetic measure: 11 females, 11 males

PROCEDURE

- Lexical-phonetic development measurements:
  - "Goodness" Ratings: Visual Analog Scaling
    - Stimuli: "s" and "sh" initial whole words
    - Participants asked to rate if the stimuli was a "good 's'" (and "sh") or a "bad 's'" (and "sh")
   - Participants clicked on a line scale to indicate perceptual judgment.
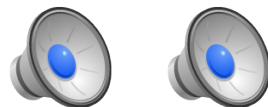
PROCEDURE

- Socio-phonetic development measurements
  - Gender Ratings: Visual Analog Scaling
    - Stimuli: "s" and "sh" initial whole words
    - Participants rated each word to determine if it sounds more like a boy or a girl
    - Gender ratings quantified by average click locations along the scale in association with the stimuli's gender.

Definitely a boy ⟵⟶ **Definitely a girl**
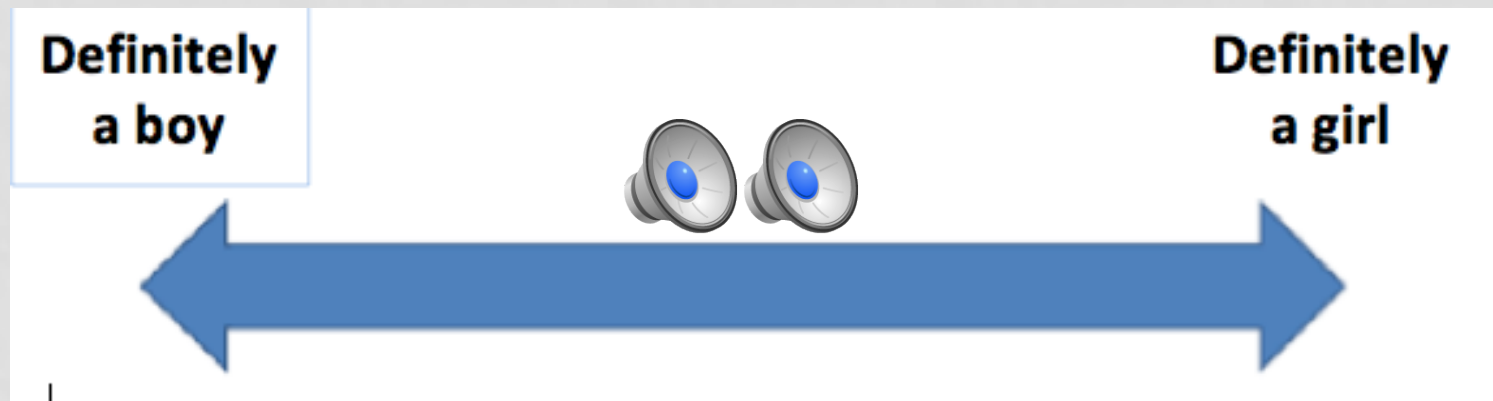
ANALYSES

- <u>Correlations</u>
  - Peak ERB and VAS goodness ratings for "s" and "sh"
  - Robustness of contrast and VAS goodness ratings for "s" and "sh"
  - Robustness of contrast and VAS gender ratings
  - VAS goodness ratings and VAS gender ratings

RESULTS AND DISCUSSION

- <u>Question 1</u>: Is there a relationship between acoustic and perceptual measures of lexical-phonetic development?

- <u>Answer</u>: Yes for "sh" but not for "s"
  - Significant correlations between "sh" goodness ratings and acoustic measures.
  - No relationship between "s" goodness ratings and acoustic measures.
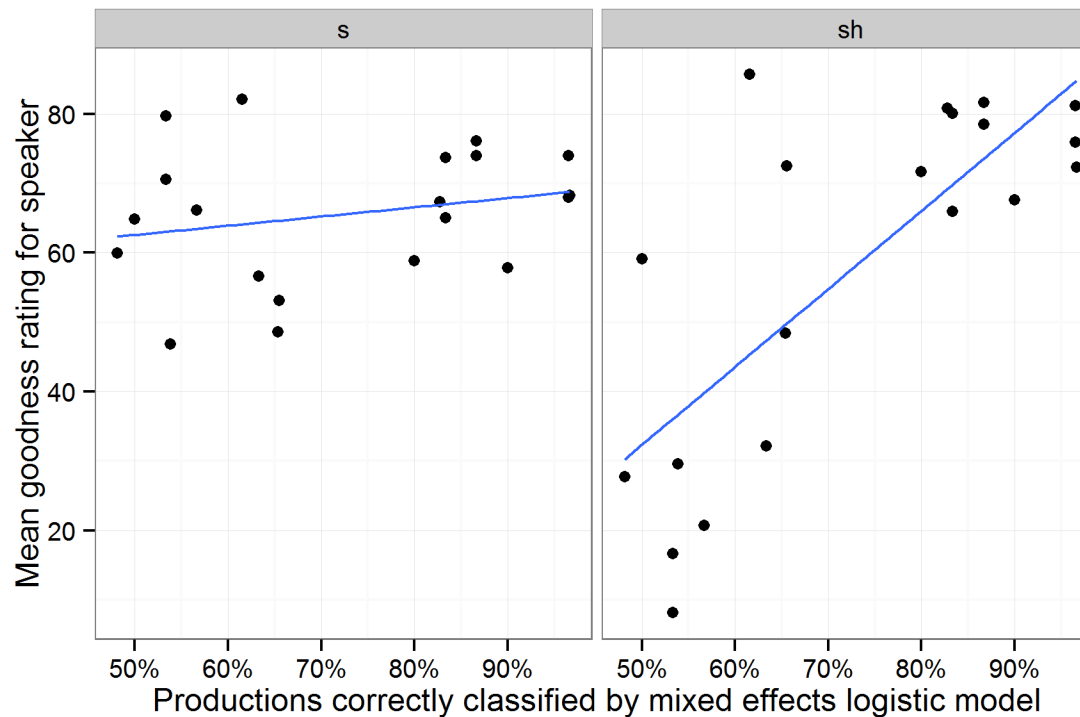
RESULTS AND DISCUSSION

- Predictions:
  - Higher peak ERB for "s" → Higher goodness rating
  - Lower peak ERB for "sh" → Higher goodness rating
    - True for "sh" but not "s"
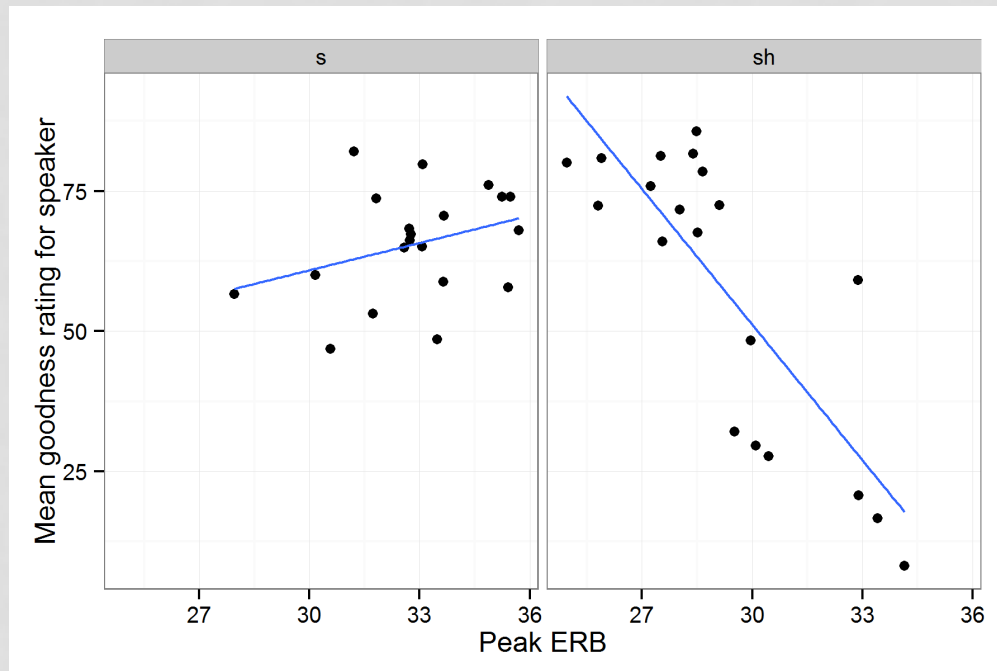
RESULTS AND DISCUSSION

- Predictions: Higher robustness of contrast measure → higher goodness rating
  - True for "sh" but not "s"

RESULTS AND DISCUSSION

- Why are the acoustic and perceptual measures related for "sh" but not "s"?

- Could it be because "s" (but not "sh") is already acquired by the females in the sample?

  - Child speakers are 3;5 to 4;0 years old.

*Age of acquisition for "s" and "sh" (75% accuracy)*

Sound	Female	Male
"s"	3:0 years	5:0 years
"sh"	4:0 years	5:0 years

Iowa-Nebraska Articulation Norms Project: Smit, et. al. (1990)

- "s" and "sh" are typically acquired later in males

RESULTS AND DISCUSSION

- What if we split the data between male and female stimuli?
  - For "s", there is somewhat more of a relationship between goodness ratings and peak ERB for males than for females.
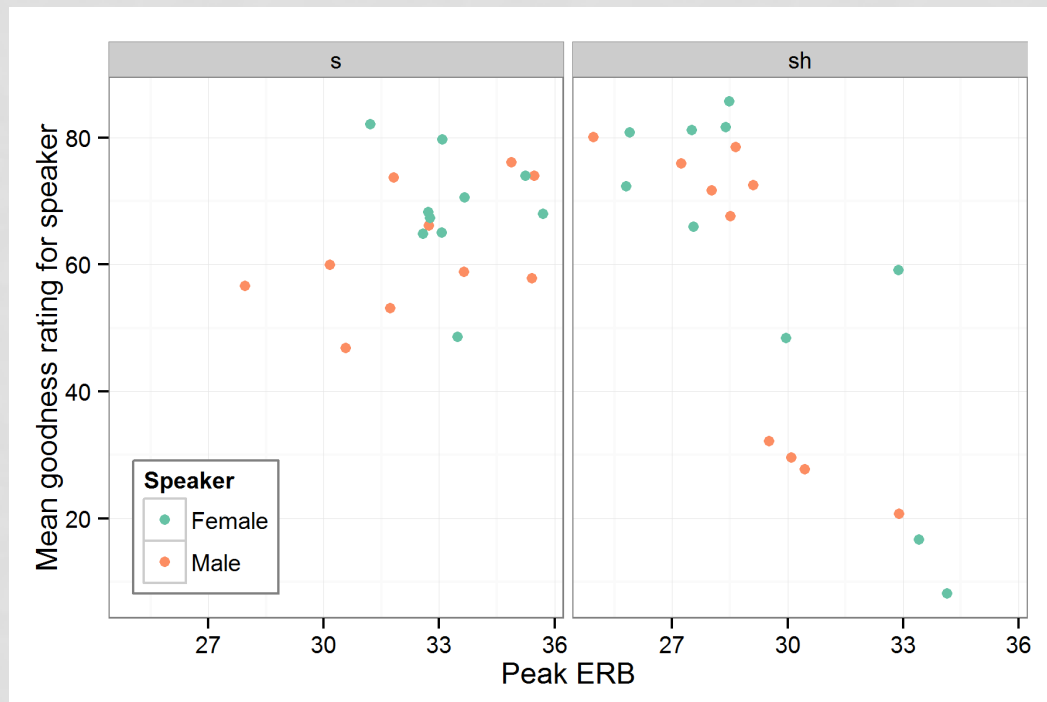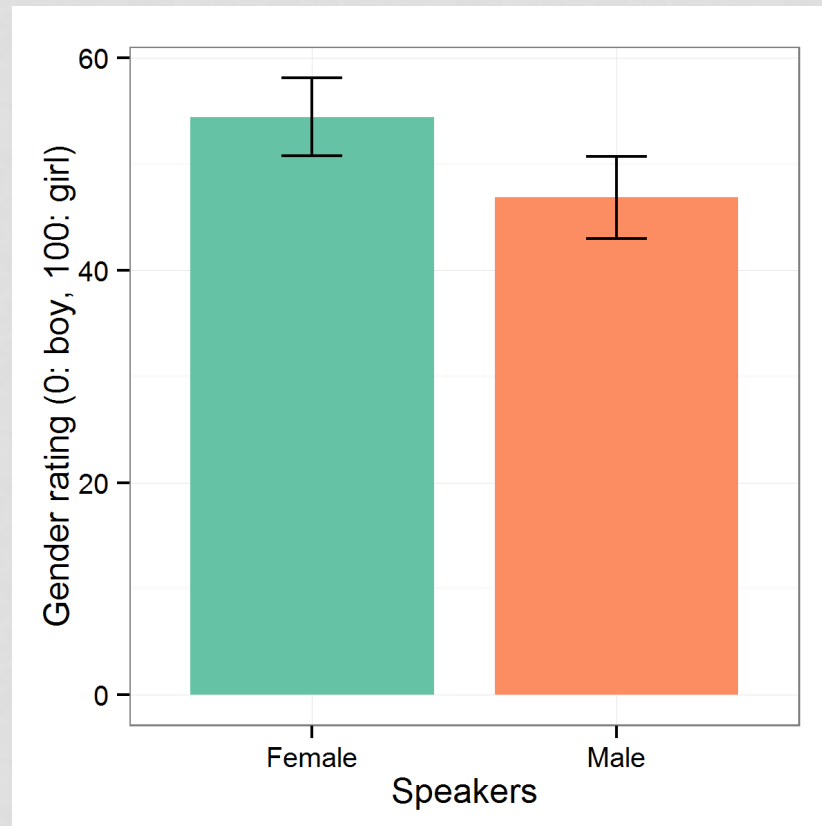
RESULTS AND DISCUSSION

- Question 2: Are the lexical-phonetic and the socio-phonetic measures related?

- Answer: No.
  - No significant correlation between acoustic measures/perceptual goodness measures and gender rating.
  - Why is this?

RESULTS AND DISCUSSION

- Participants unable to accurately identify speakers as male or female in this experiment

RESULTS AND DISCUSSION

- Why were participants unable to identify stimuli gender?

  - Single words

  - Not enough variety of sounds

  - Stimuli came from children 3.5 – 4 years

WHAT DOES THIS ALL MEAN?

- Are acoustic measures and perceptual measures of lexical-phonetic development related?
  - Yes. This is important in treating children with speech sound disorders.
  - Instead of relying only on transcription, we can collect perceptual data on children's productions. Much less time-consuming than acoustic analysis
- Is lexical-phonetic development and socio-phonetic development related?
  - The two forms of development were not related at the age tested in this study.
  - What if we tested at a later age?

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