How a cross-linguistic study of phonological development can inform clinical practice

ASHA, 2011

Jan R. Edwards, Mary E. Beckman, and Benjamin Munson

Please come to the front of the room and sign out a response clicker – thanks!!!

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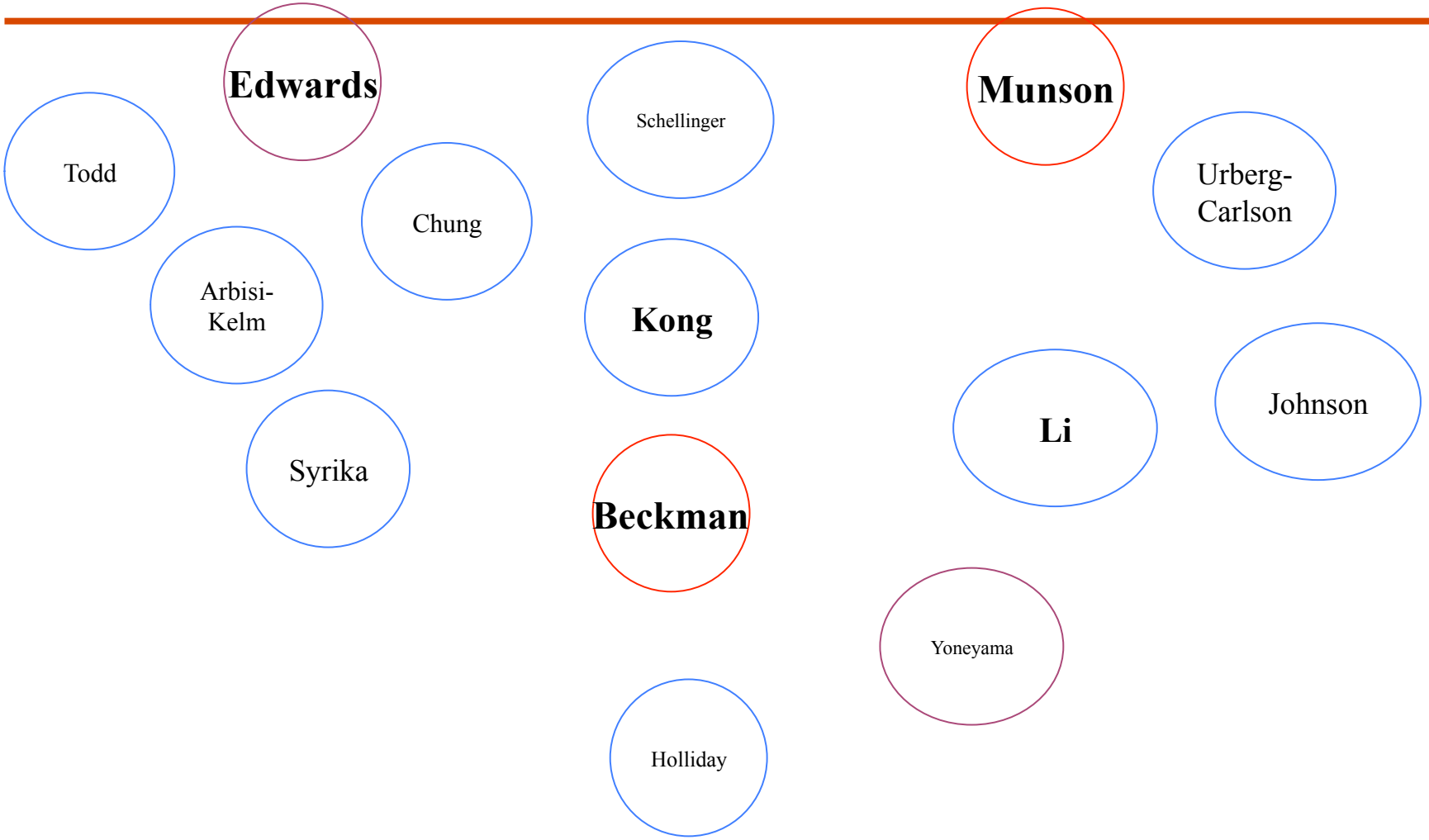
NIDCD grant RO1 02932 to Edwards and NSF grants BCS 0729140, 0729306, 0729277 to Edwards, Beckman, & Munson

A complex web of collaborators



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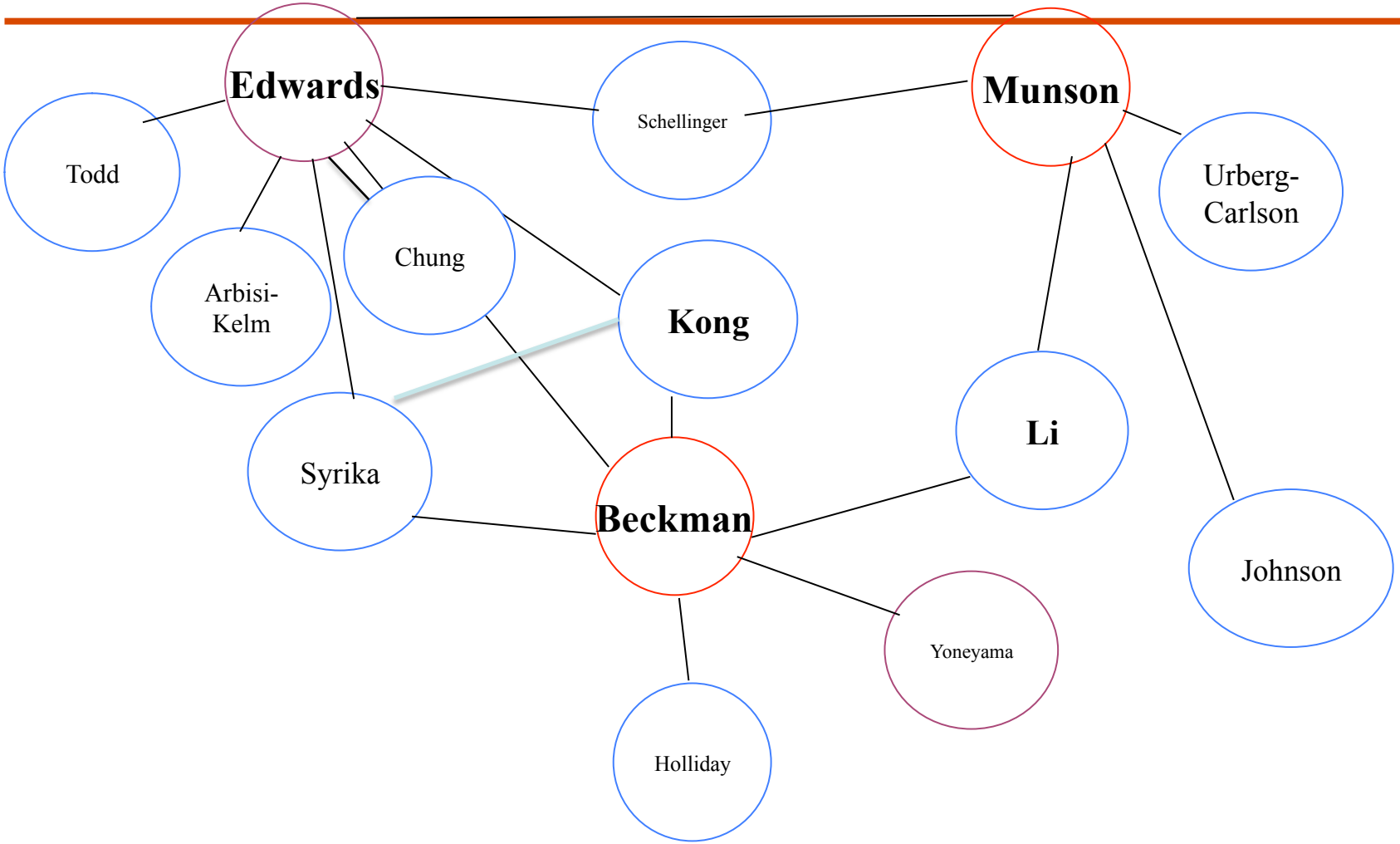

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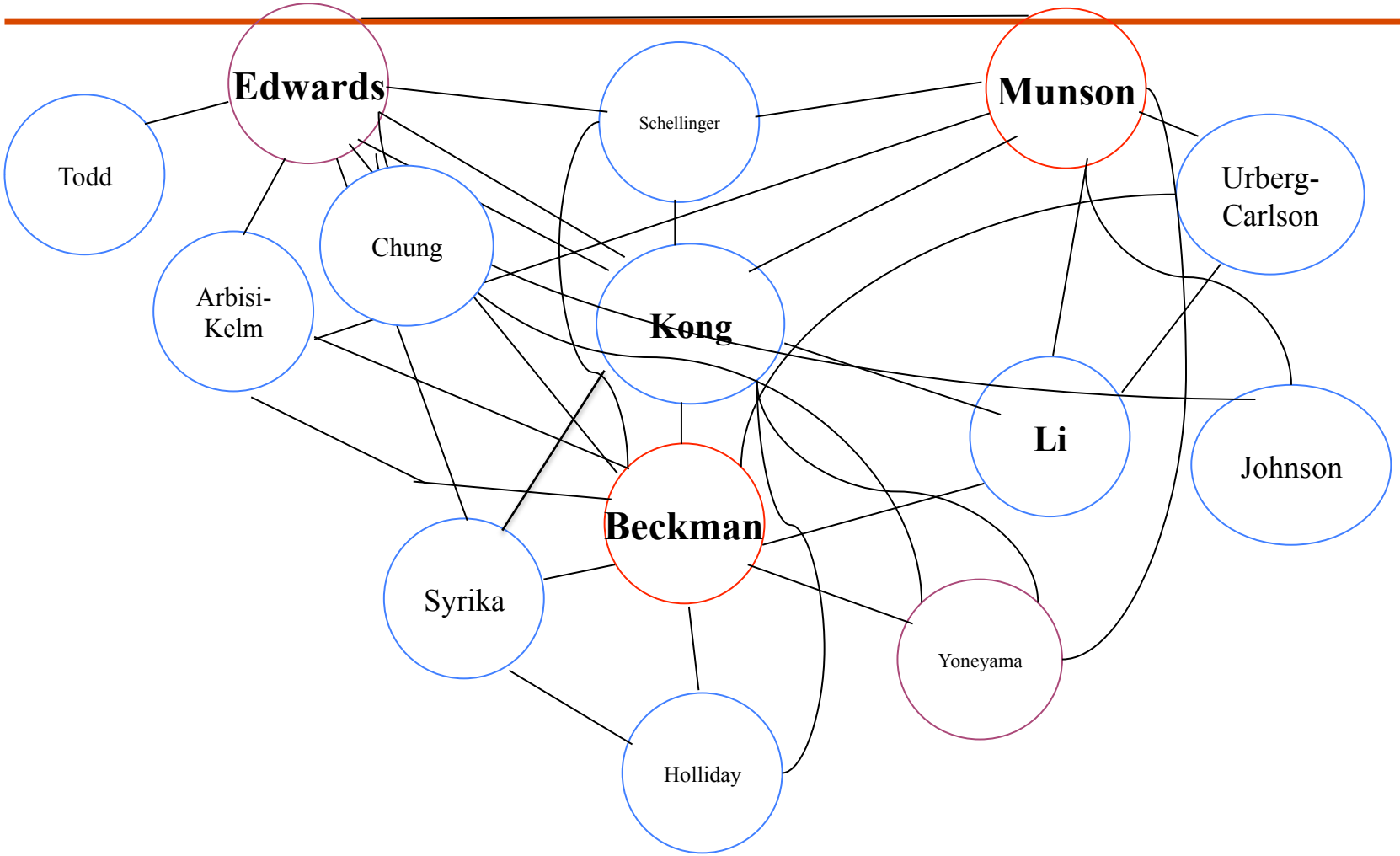


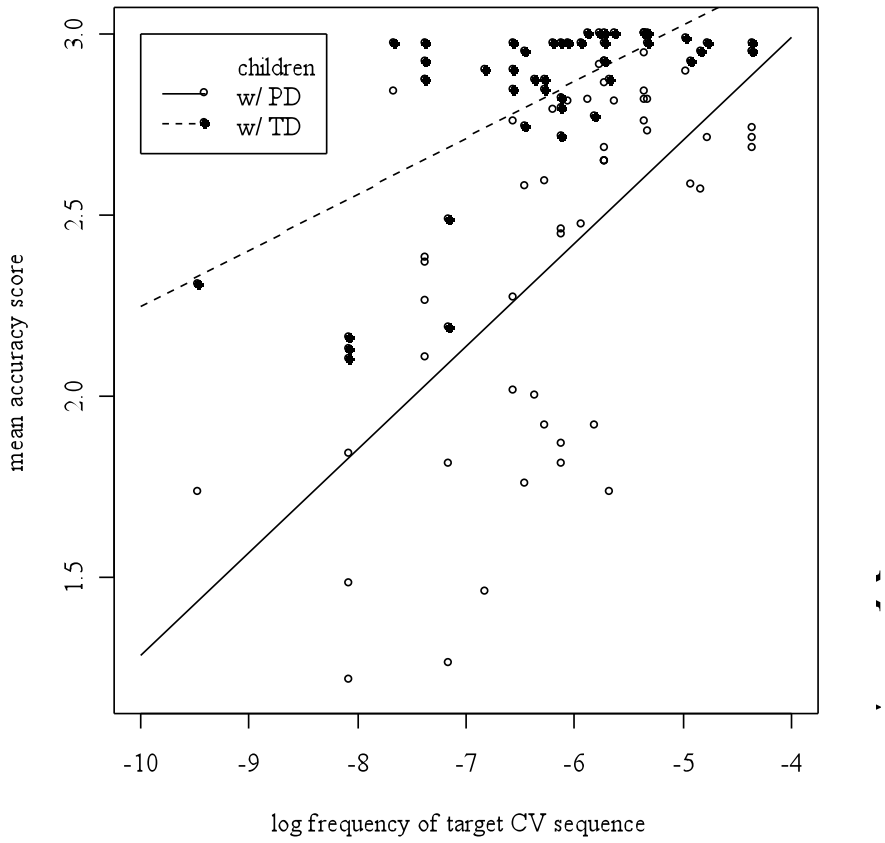
Why you should stay

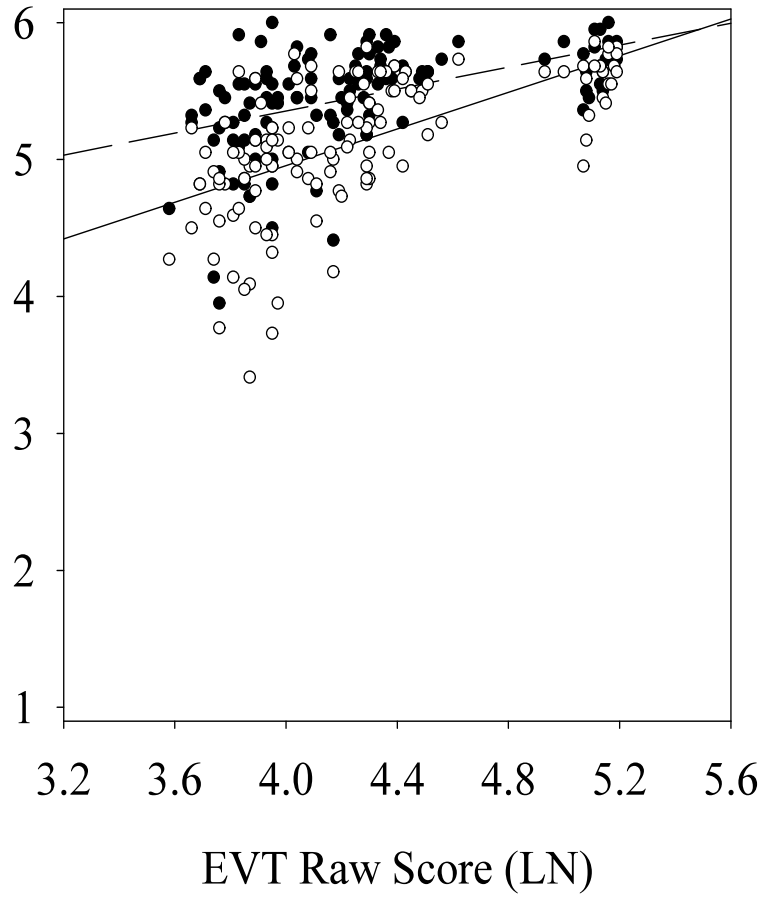
The million dollar question:

How is a study of phonological acquisition across languages informative for clinical practice in the United States?

Our original motivation

- Do children learn sounds or do they learn sounds in words?





What did we learn?

- Children learn sounds in words.

What *else* did we learn?

- We can't rely only on transcription because:
  - There are language-specific differences in perception.
  - All incorrect productions are not the same.
  - All correct productions are not the same.
  - Children are learning more than simply how to produce speech sounds correctly.

Methods

– Languages: English, Cantonese, Greek, Japanese, (Korean, Mandarin)

– Target consonants: word-initial lingual obstruents

– Procedure: Auditory word-repetition task

– Participants: 100 2- to 5-year olds for each language.

– Analysis:
  - Transcription
  - Acoustics
  - Naïve speaker perception

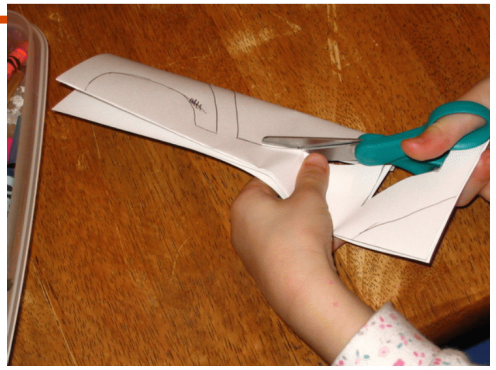
Example stimuli for /k/ in English

kaytush

key

coffee

cube



cutting

cougar

coat

quick

Example stimuli for /k/ in Japanese

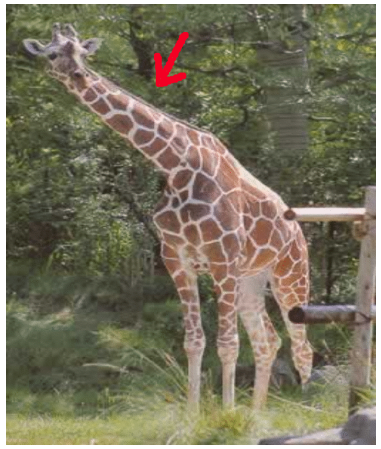
[kʲimono]

[kʲe:ki]

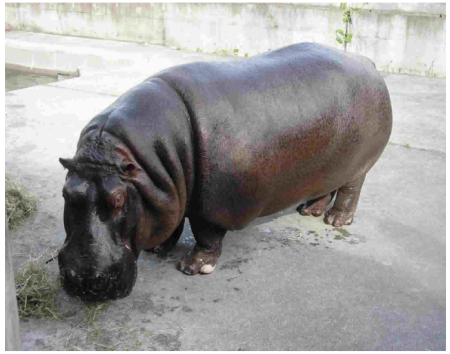
[kuma]

[kuruma]

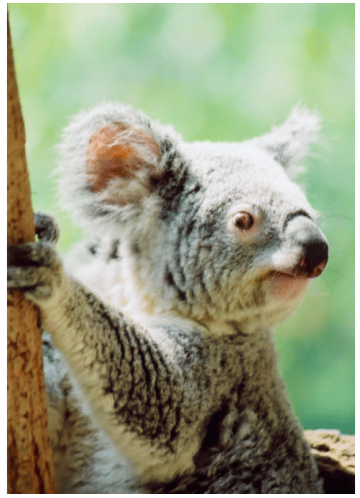
[kubi]



[kʲu:ri]

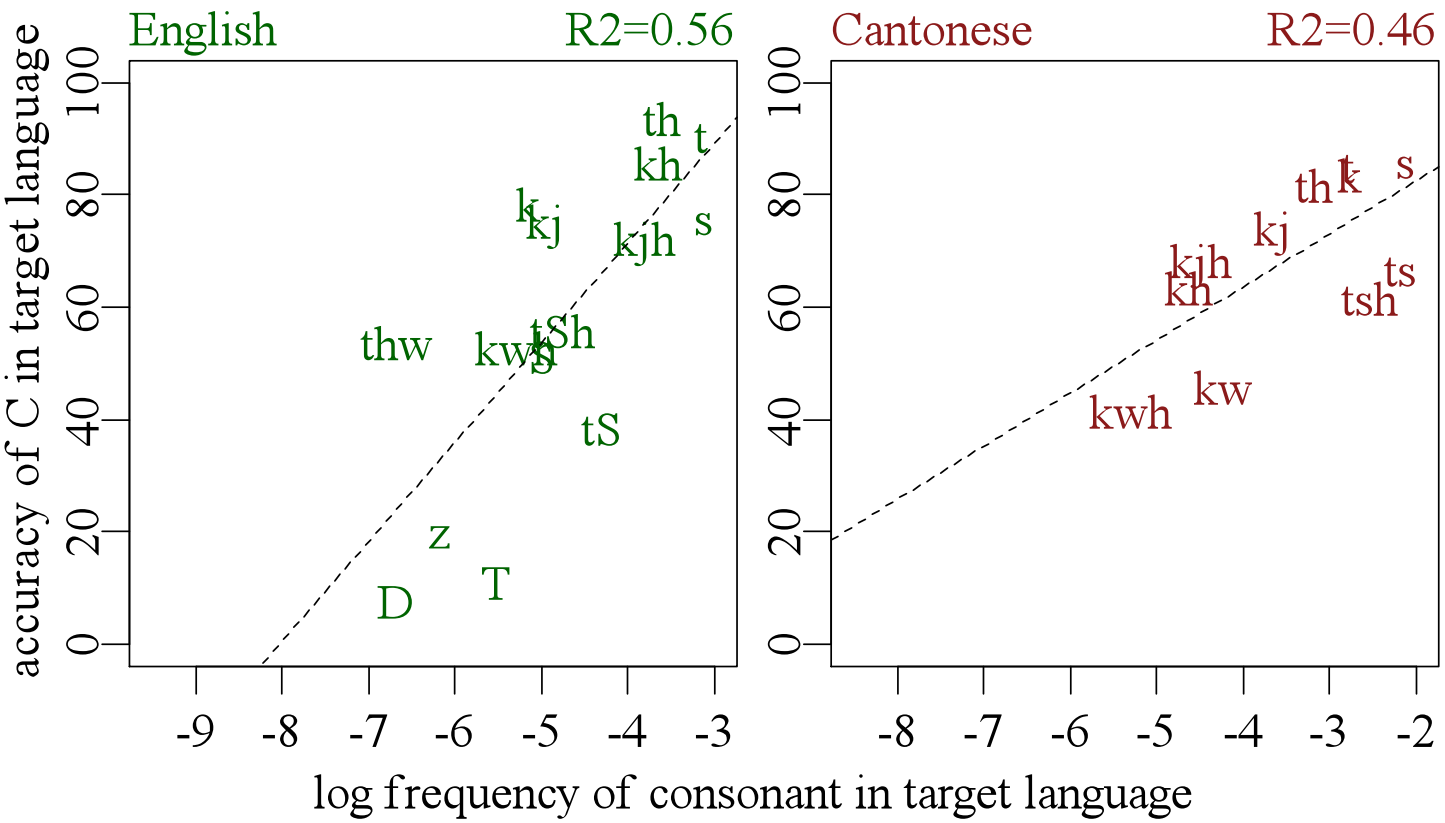


[kaba]

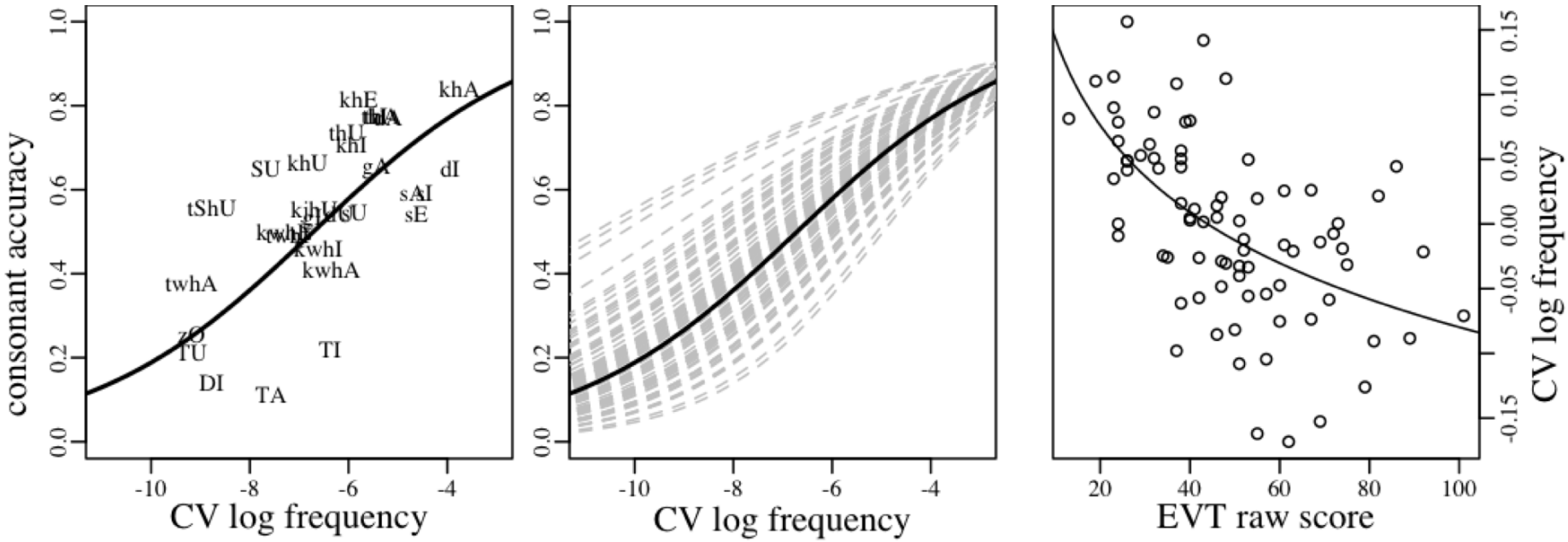


[koara]

Result 1: Children learn sounds in words



Result 1: Children learn sounds in words

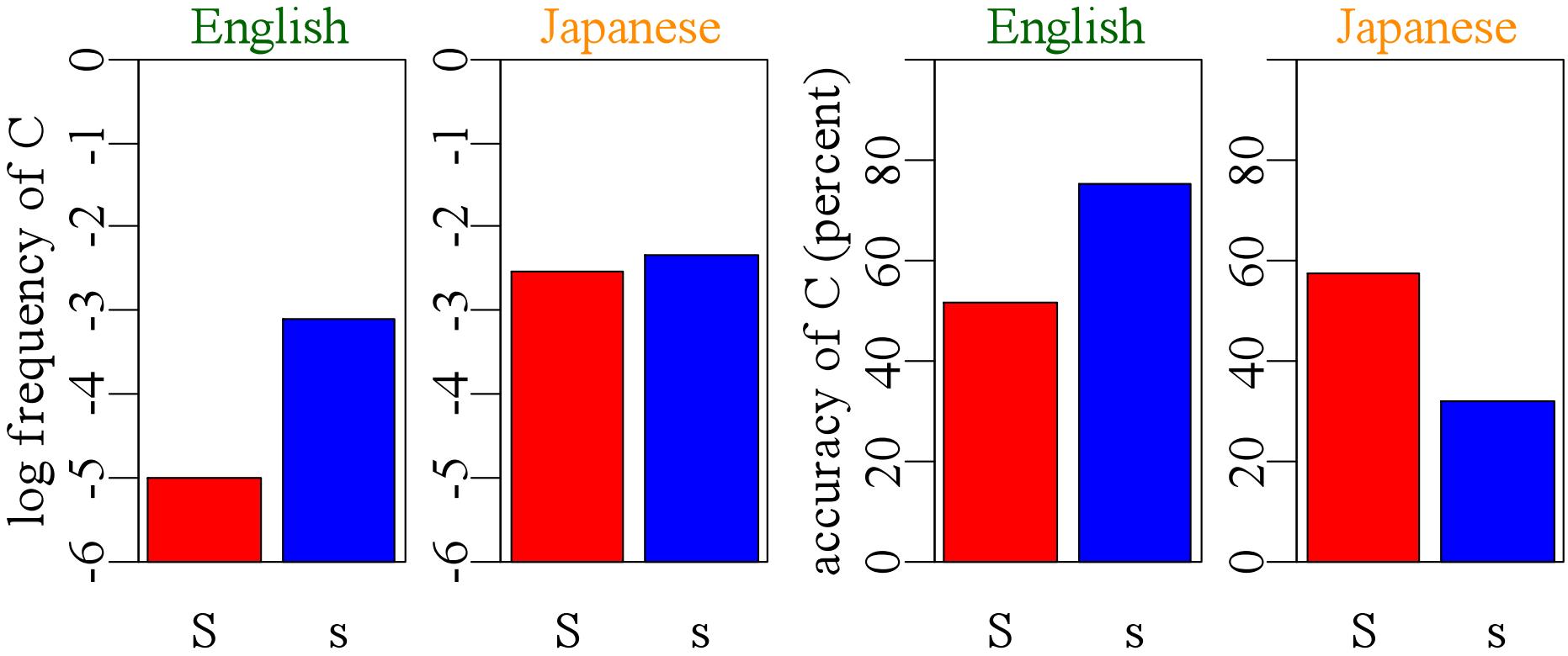


Result 2: Language-specificity in perception

- Cross-linguistic differences in phoneme frequency do not explain all language-specific patterns.

- Sibilant fricative contrast in Japanese acquired later than similar contrast in English, although phoneme frequencies are similar (Li et al., 2010).

Result 2: Language-specificity in perception



Result 2: Language-specificity in perception

- Why is /s/ produced with such low accuracy by Japanese-speaking 2- and 3- year olds?

- Why is /s/ produced with such high accuracy by English-speaking 2- and 3- year olds?

Result 2: Language-specificity in perception

- English:
  - /s/ is mastered earlier than /ʃ/
  - [s] is substituted for /ʃ/

shoe *safe*

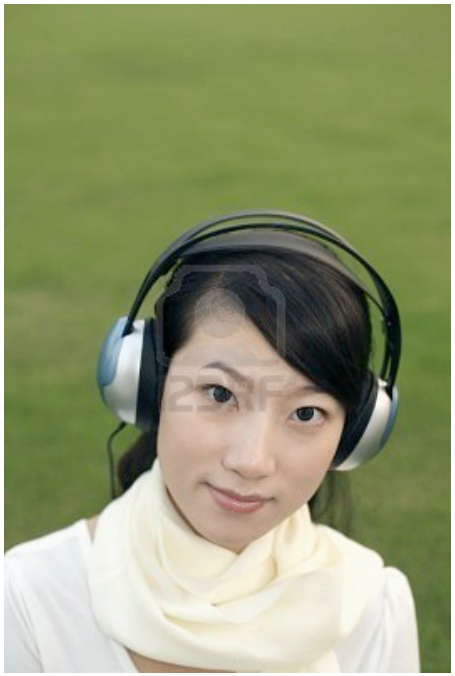
- Japanese:
  - /ʃ/ is mastered earlier than /s/
  - [ʃ] is substituted for /s/

Shukurimu "cream puff" *semi* "cicada"

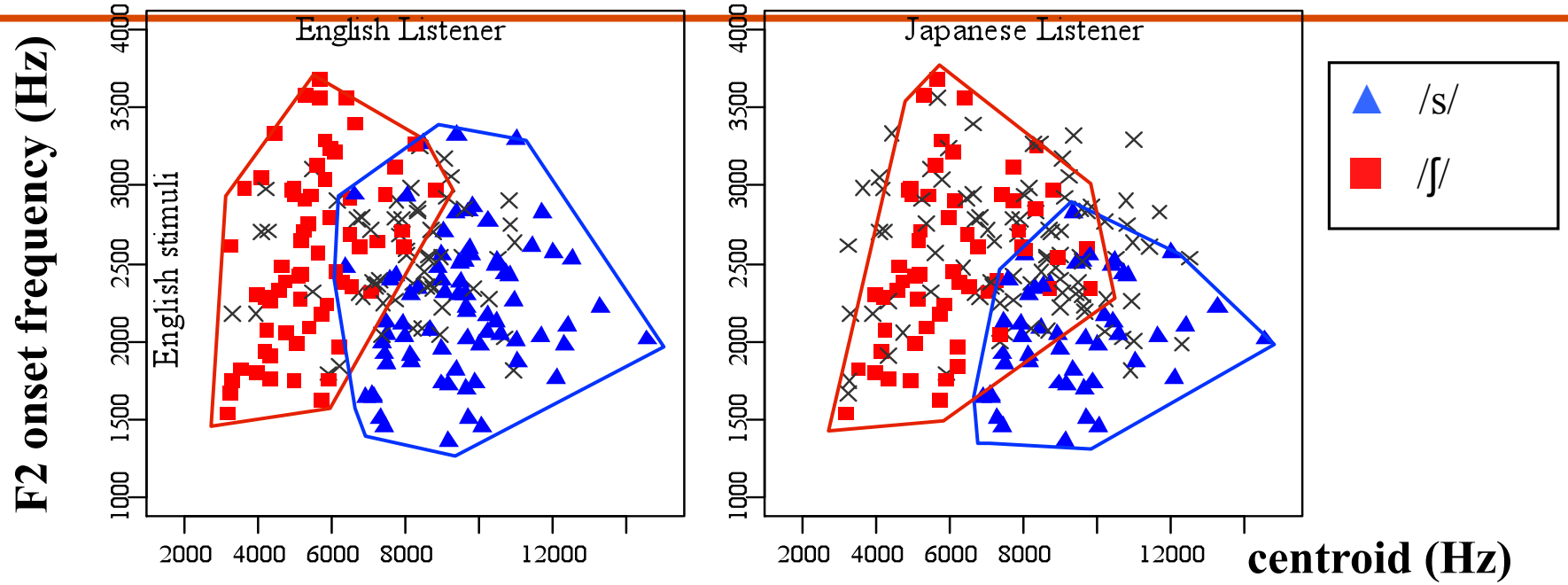
 

Result 2: Language-specificity in perception

- Question:
  - Are there differences in how adult native speakers of English and Japanese perceive children's /s/ and /ʃ/ productions?
- Participants:
  - English speakers (Minneapolis, MN))
  - Japanese speakers (Tokyo, Japan)
- Stimuli:
  - CV sequences
  - Correct productions of /s/ and /ʃ/ *and* prototypical
  - substitutions of children in each language.
- Task: Is it an /s/? Is it an /ʃ/?



Result 2: Language-specificity in perception



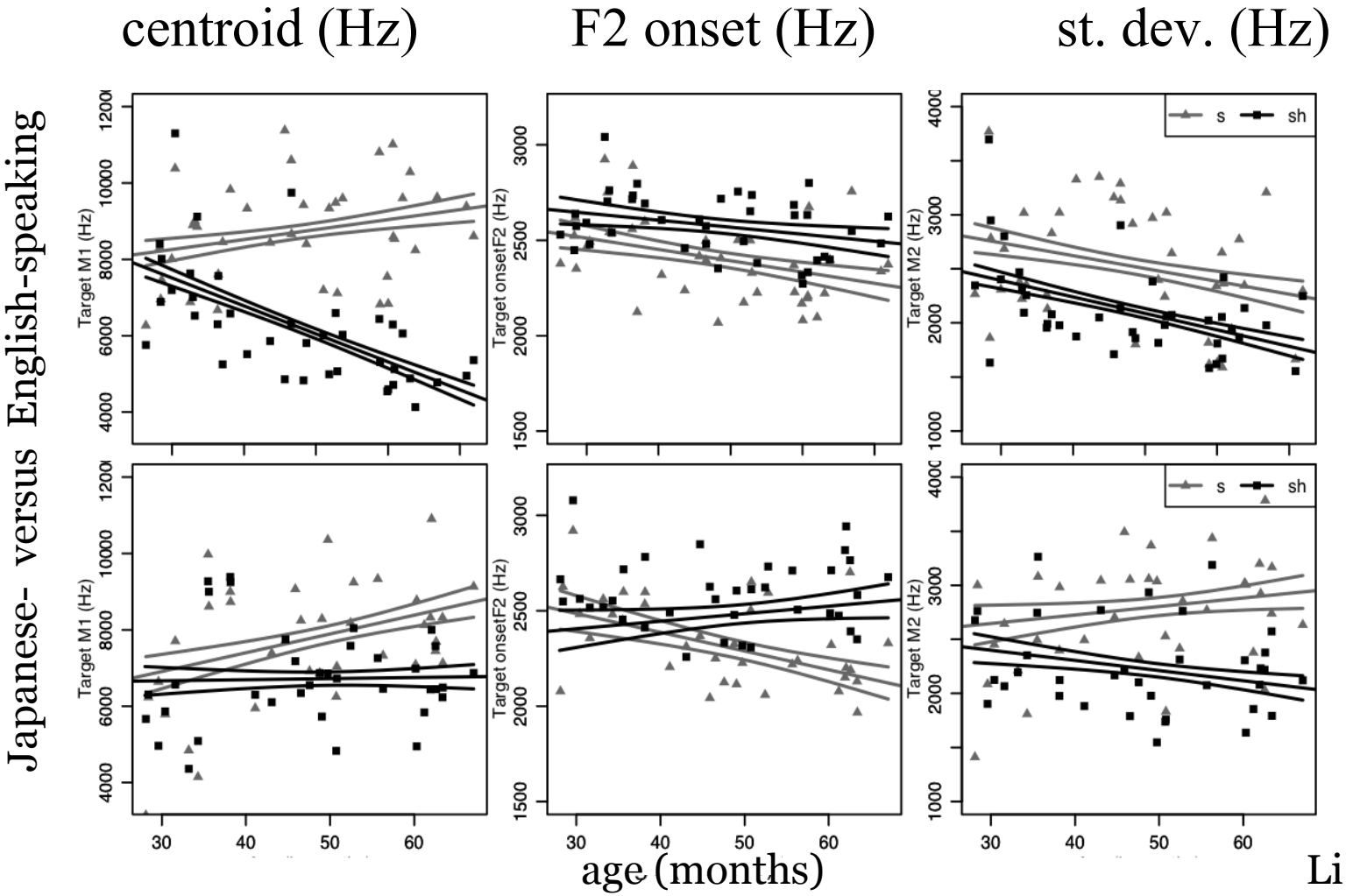
- English listeners: Larger acceptable range for /s/
- Japanese listeners: Larger acceptable range for /ʃ/

Result 3: All incorrect productions are not the same

Problems with transcription.

1. Depends on listener's experience and expectations.
2. Children do not progress directly and categorically from incorrect to correct productions.
   - All incorrect productions are not the same.
   - All correct productions are not the same.

Result 3: All incorrect productions are not the same



Li (2008)

Result 3: All incorrect productions are not the same

– Transcription analysis: We observed many intermediate productions.

– English: [k] or [g] 

[f] or [θ] 

– Greek: [k] or [t] 

[s] or [θ] 

Result 3: All incorrect productions are not the same

- Question:
  - Can naïve listeners reliably categorize productions as intermediate between /s/ and /θ/ (Schellinger et al., 2008)?

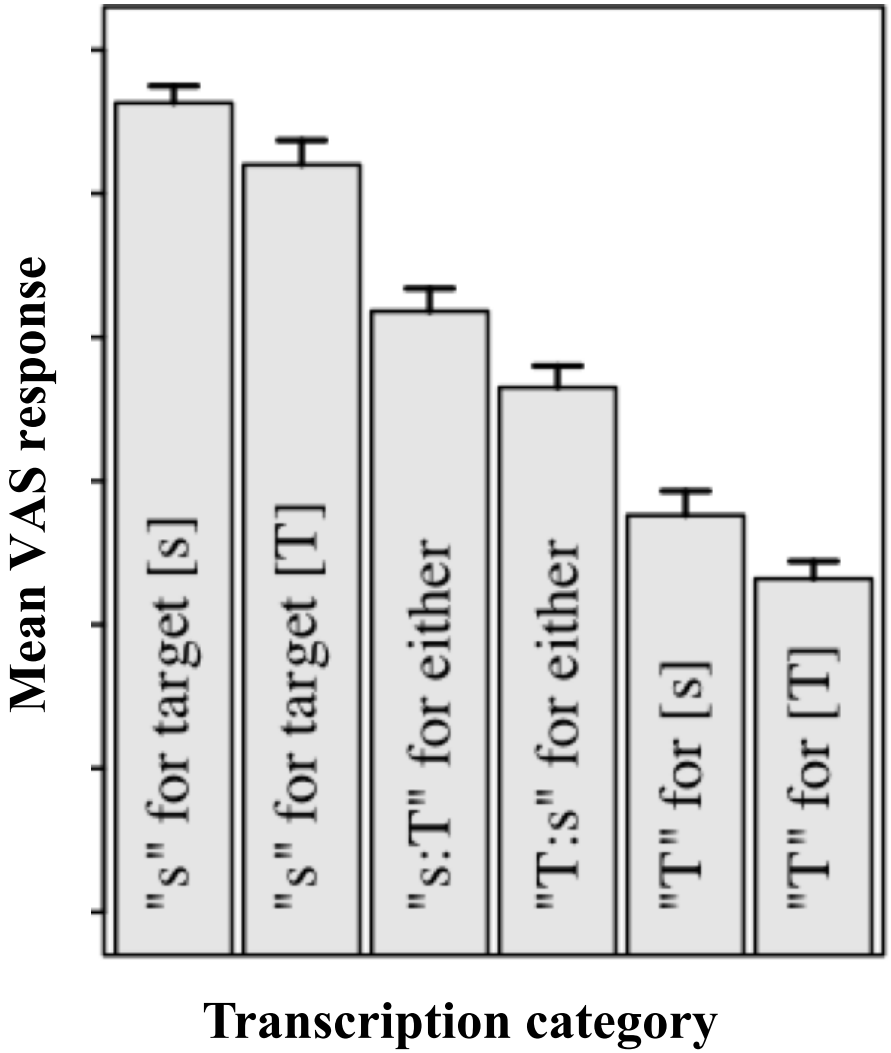
- Participants:
  - naïve adult listeners

- Method: Visual analog scaling

Result 3: All incorrect productions are not the same

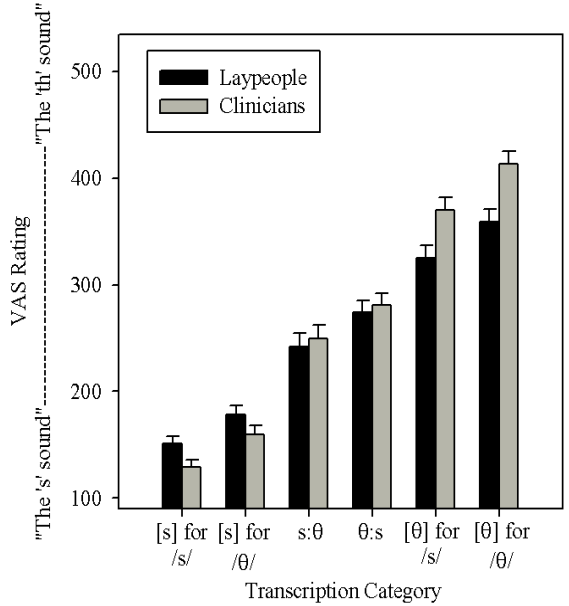
- Stimuli:
  - 200 CV sequences.
    - correct /s/
    - [s] for /θ/
    - intermediate: closer to [s] than [θ]
    - Intermediate: closer to [θ] than [s]
    - [θ] for /s/
    - correct /θ/

Result 3: All incorrect productions are not the same

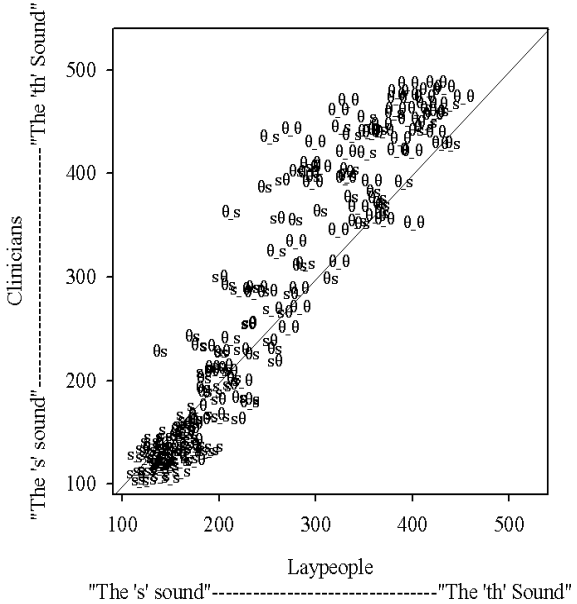


Result 3: All incorrect productions are not the same

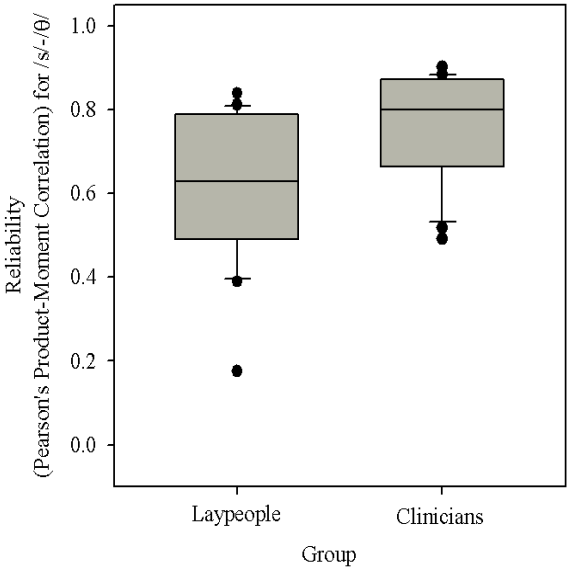
Speech-language pathologists do it better! (Munson, Johnson, & Edwards, 2010)



Their responses better differentiate among transcription categories



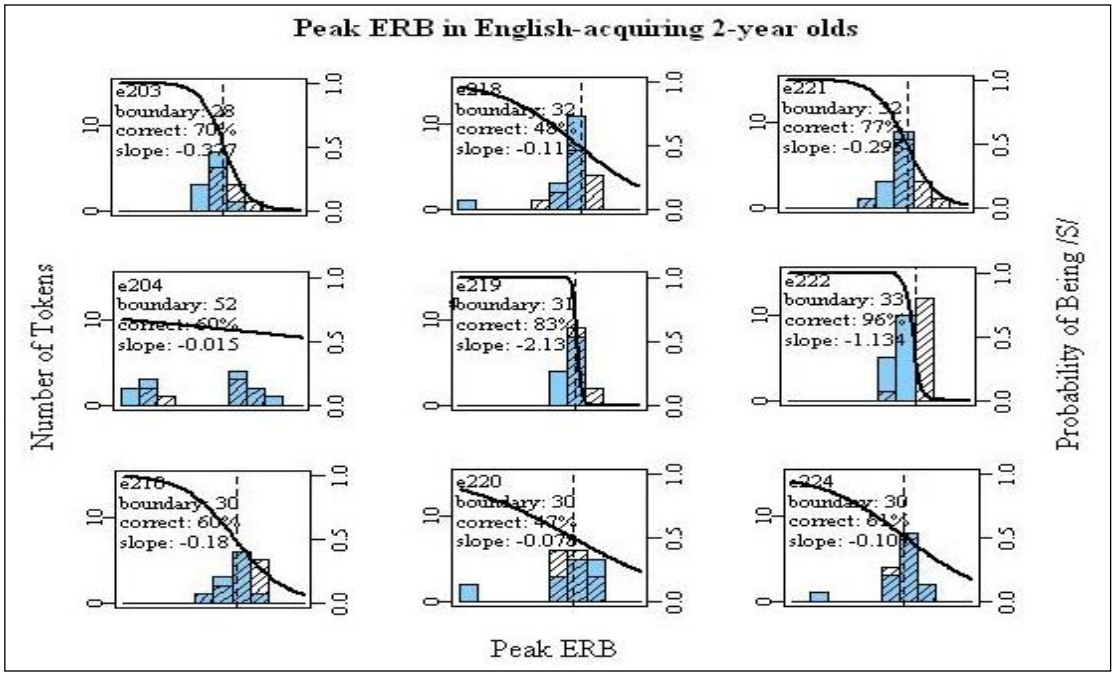
They don't have as strong a bias to label sounds as 's'

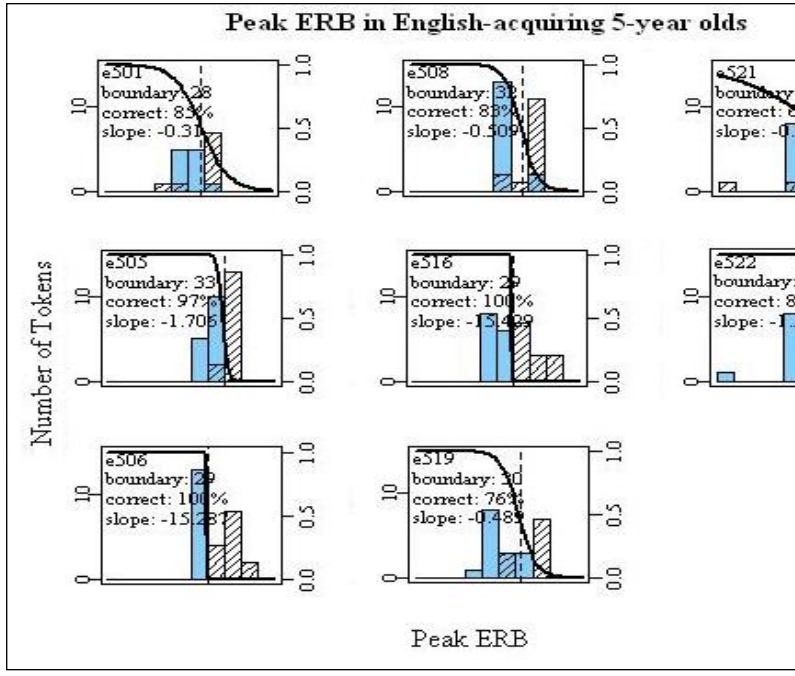


They have superior intra-rater reliability

Result 4: All correct productions are not the same

Holliday et al., 2010



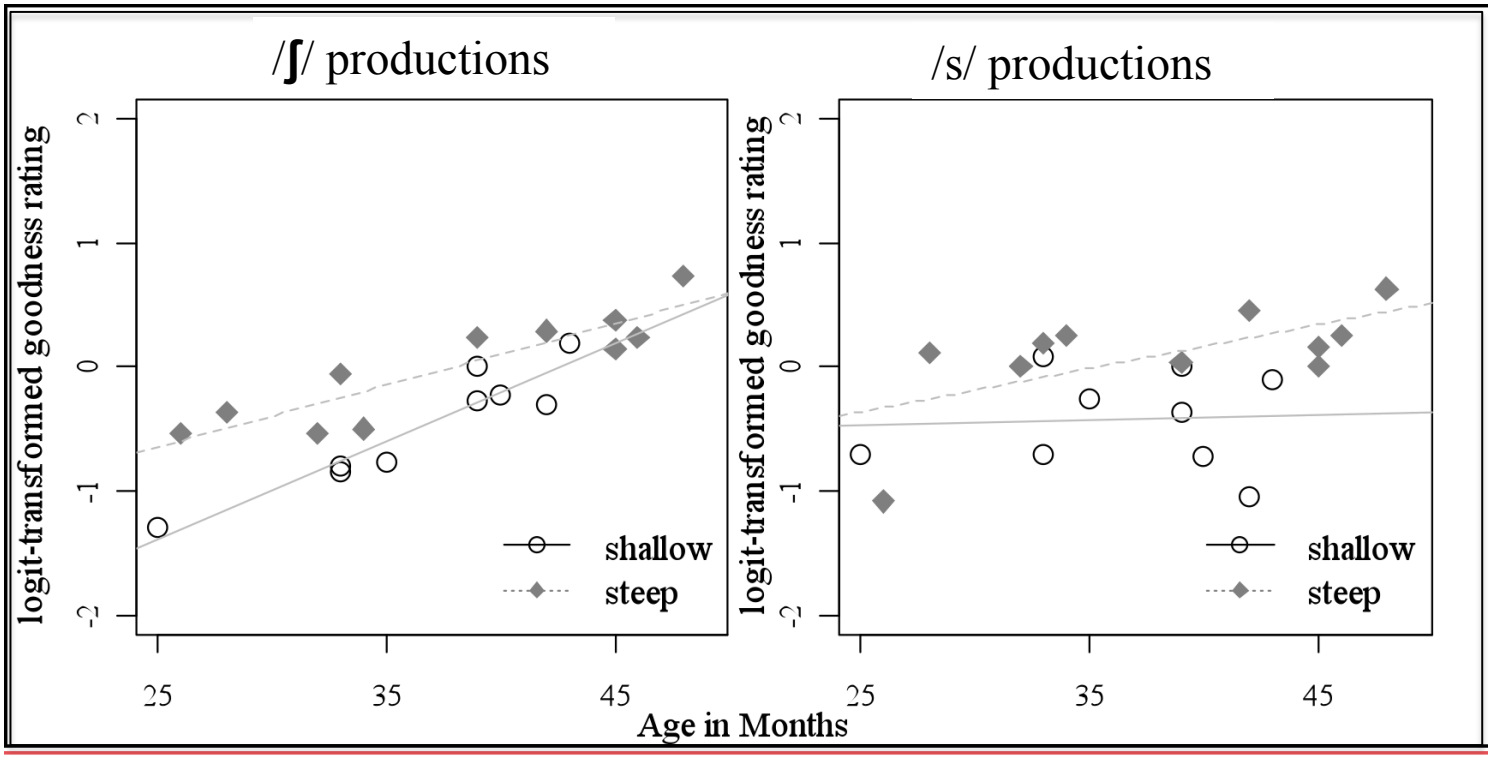


Result 4: All correct productions are not the same

- Question:
  - Do naïve listeners rate productions from children with steep slopes differently than productions from children with shallow slopes (Sovinski, 2011)?
- Participants:
  - naïve adult listeners
- Method: Direct magnitude estimation

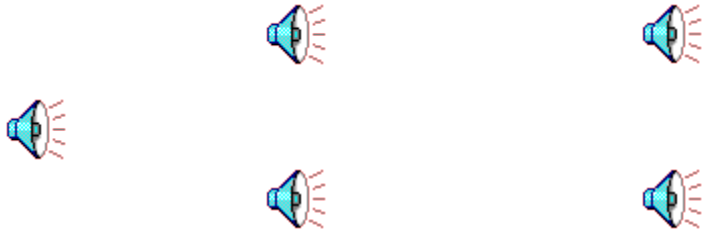
Good "s" ⟷ Bad "s"

Result 4: All correct productions are not the same



Result 5: There's more to phonological development than phonemes

- Speech sounds encode at least two kinds of information:
  - Lexical information
  - Socio-indexical information



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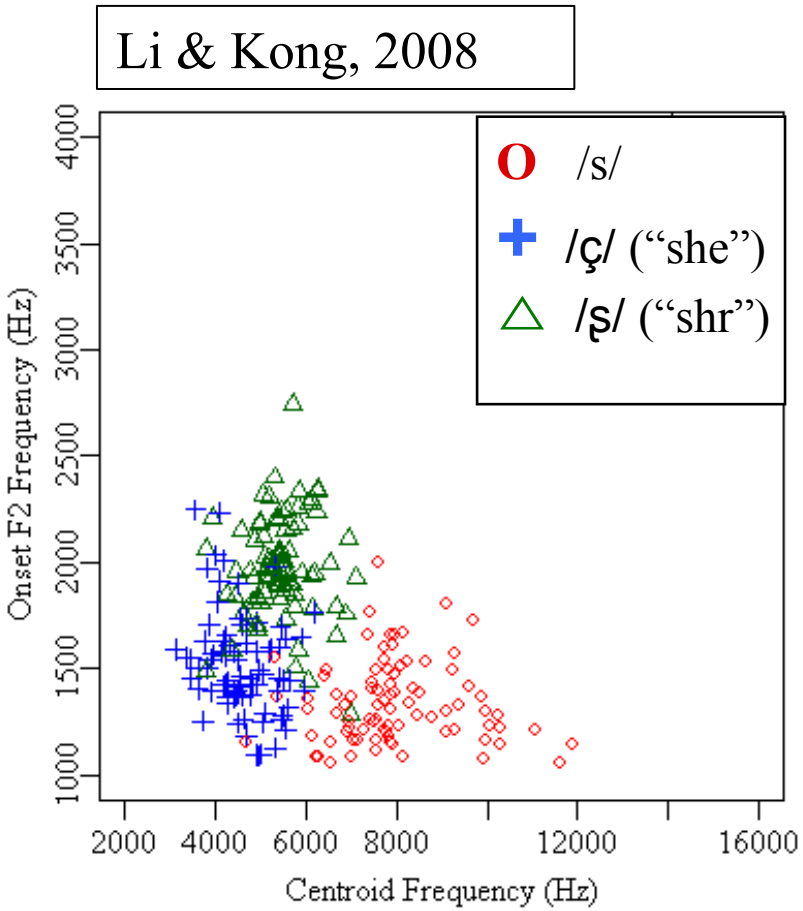
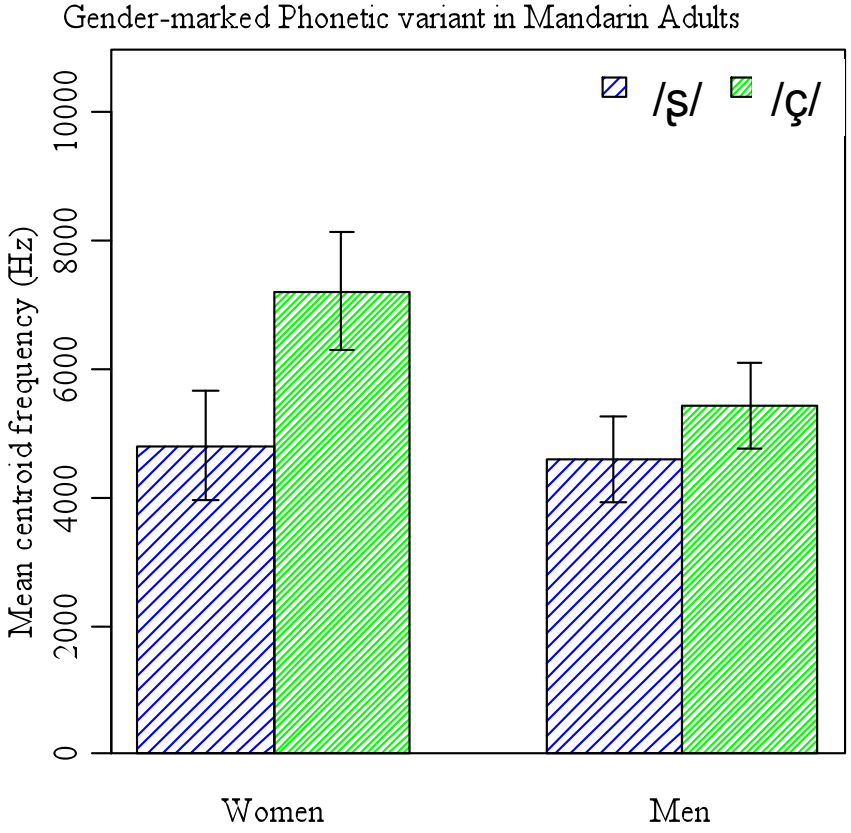


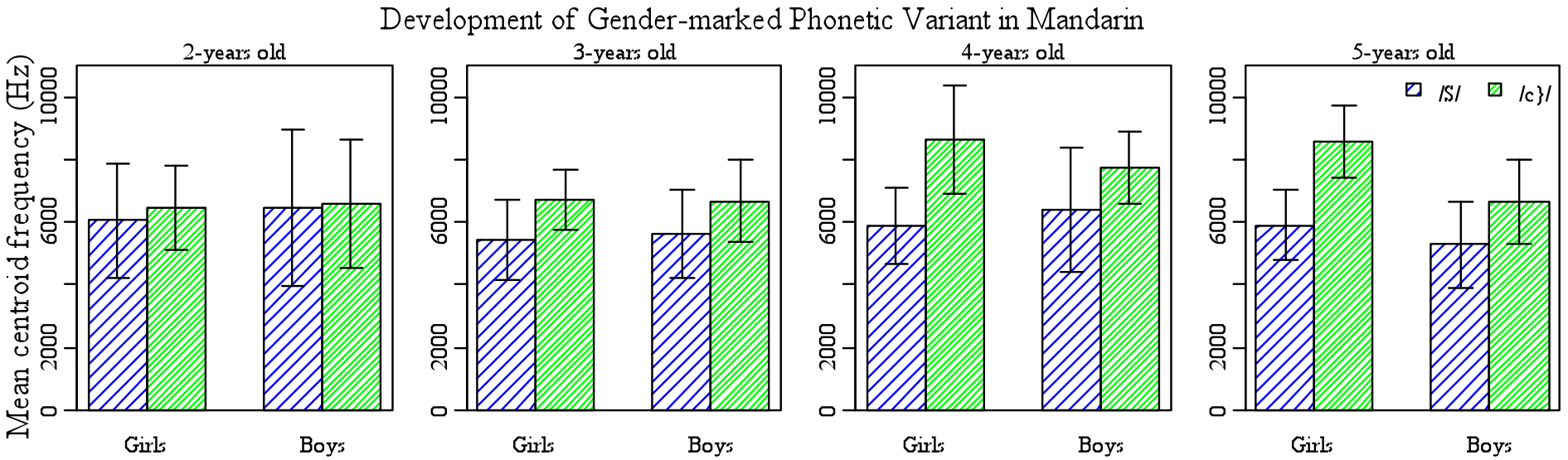
- Mandarin has two post-alveolar fricatives:
  - /ɕ/ ("she")
  - /ʂ/ ("shr")
- Onset F2 frequency (y-axis):
  - ➢ Differentiates /ɕ/ and /ʂ/
- Centroid frequency (x-axis):
  - ➢ Used for socio-indexical coding for /ɕ/.

Result 5: There's more to phonological development than phonemes



- Difference between /ç/ and /ʂ/ is greater for women than for men.
  - Without fem. accent:
  - With fem. accent:

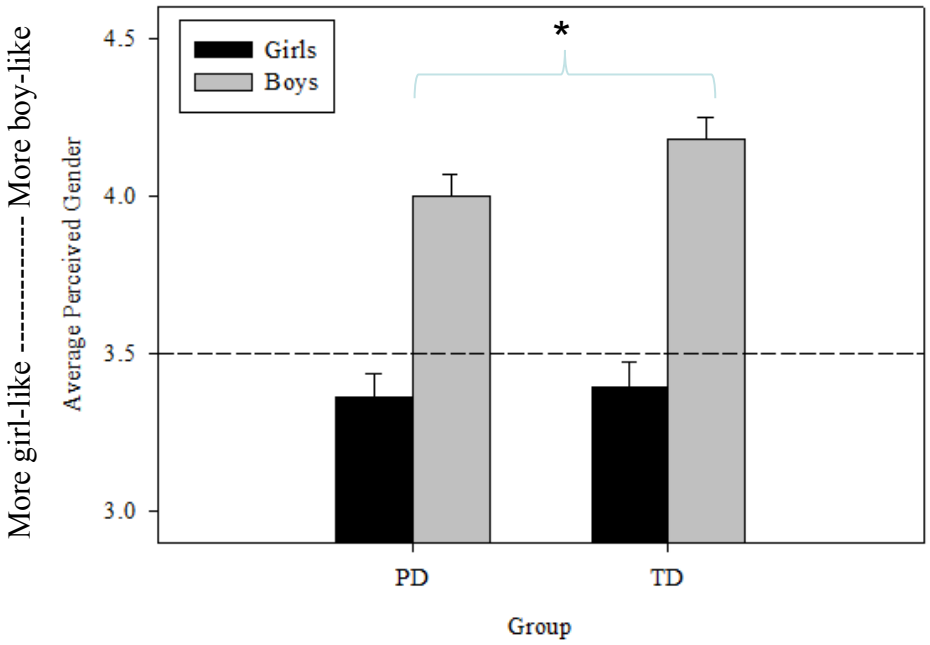
Result 5: There's more to phonological development than phonemes



Boy: Girl w/o F.A. Girl w/F.A.

Result 5: There's more to phonological development than phonemes

Munson & Baylis, 2007



- Children learn to mark their gender through phonetic variation.
- 3- 7-year-old boys with phonological disorder were rated to sound less boy-like than age peers.

More girl-like ⟷ More boy-like

What did we learn?

1. Children learn sounds in words.

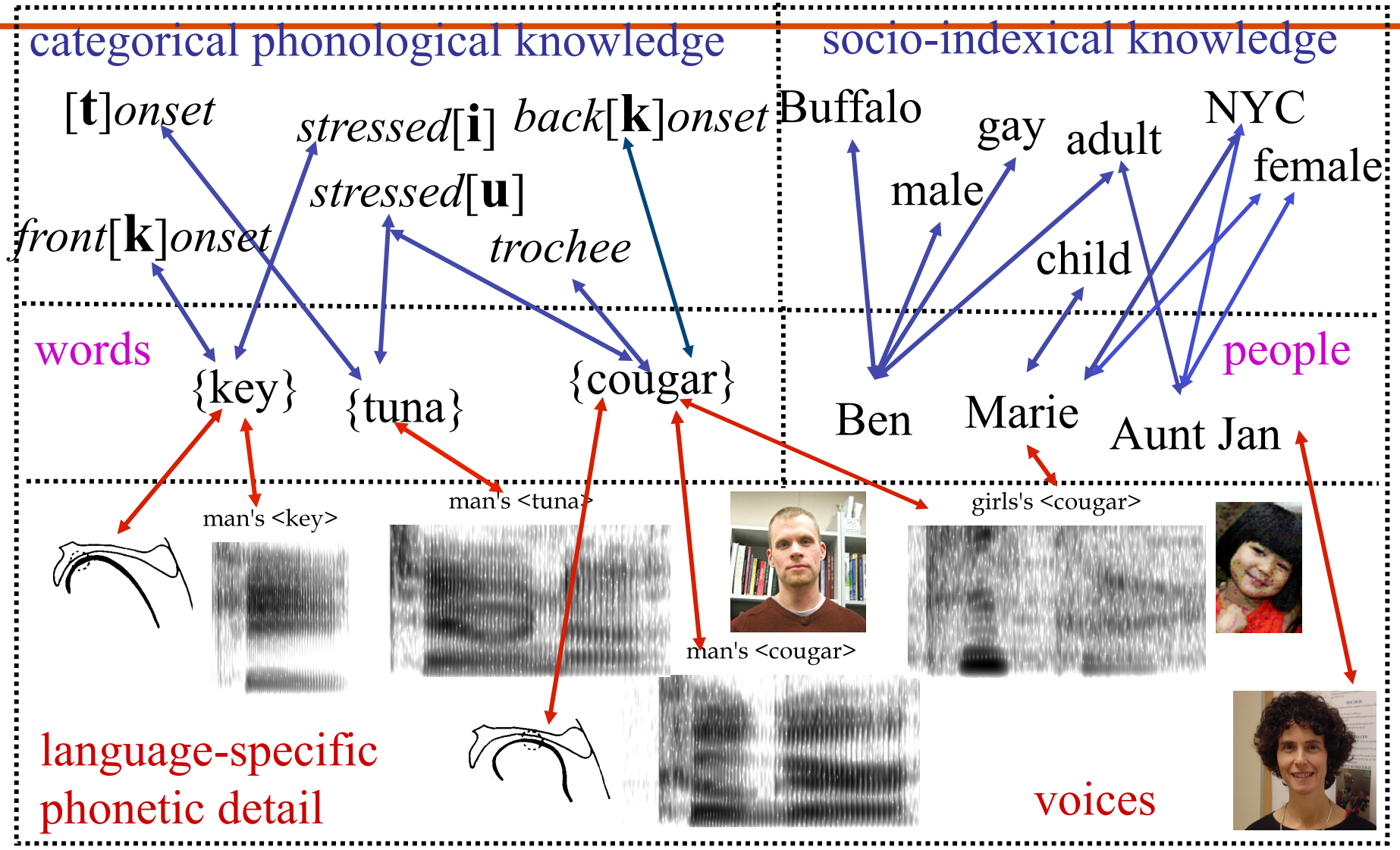
What *else* did we learn?

- We can't rely only on transcription because:
  2. There are language-specific differences in perception.
  3. All incorrect productions are not the same.
  4. All correct productions are not the same.
  5. Children are learning more than simply how to produce speech sounds correctly.

Back to the million dollar question

How can these results inform clinical practice???

Levels of knowledge about speech sounds



How can these results inform clinical practice?

- Result 1: Children learn sounds in words.
- Need to consider the words a child knows as well as the sounds he/she knows.
- Children with phonological disorders have smaller vocabularies than their typically developing peers.

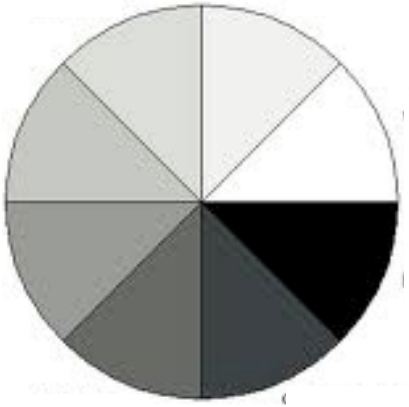
How can these results inform clinical practice?

- Result 2: We can't rely only on transcription:
  - There are language-specific differences in perception.

- Transcription is influenced by listeners' linguistic experience (and expectations).

How can these results inform clinical practice?

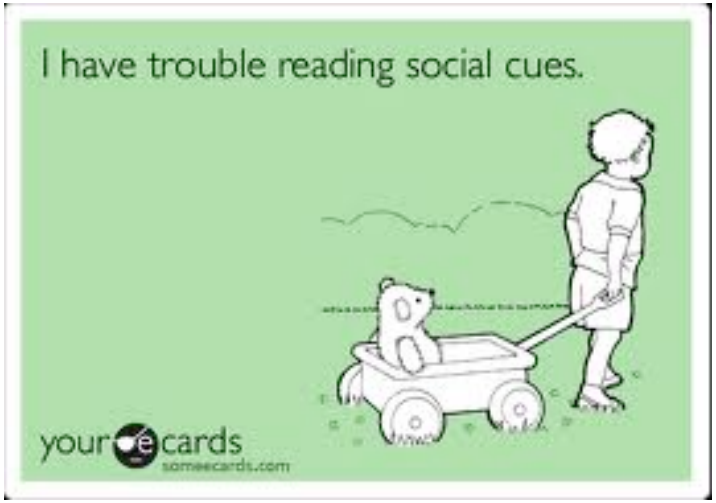
- Result 3-4: We can't rely only on transcription:
  - All incorrect productions are not the same.
  - All correct productions are not the same.



How can these results inform clinical practice?

- Result 5: We can't rely only on transcription:
  - There's more to phonological development than phonemes.

- Some language disorders characterized by difficulties understanding social cues.
- Many social cues are signaled by sociophonetic features.



How can these results inform clinical practice?

- How can we supplement transcription?

- Clinicians are good at hearing intermediate productions.

- VAS and DME are not difficult to use in clinical practice.

Acknowledgments

- Help with local arrangements: Catherine McBride-Chang, Katerina Nicolaidis, Areti Okalidou, Kiyoko Yoneyama

- Support from NIDCD Grant 02932 and NSF Grants BCS 0729140, 0729306, and 0729277

- Participation of the children and cooperation from their parents

For all of which, a heartfelt:

謝謝　　thank you　　ευχαριστώ πολύ　　ありがとう