My Vowels Matter:
Formant Automation Tools For Diverse Child Speech

Hannah Valentine, M.S., CCC-SLP (she/her) - *New York University*

Joel MacAuslan, Ph.D. (he/him) - *STAR Corp.*

Maria Grigos, Ph.D., CCC-SLP (she/her) - *New York University*

Marisha Speights, Ph.D., CCC-SLP (she/her) - *Northwestern University*

The Problem

- Pediatric vowels have… (Vorperian & Kent, 2007)
  - high f0, which impacts F1 measurement
  - variable formant values
  - wide formant bandwidths
  - increased subglottal coupling

- Many speech disabilities are characterized by challenges with vowel productions (Ball & Gibbon, 2013)

- Midpoint ≠ steady state, especially when working with speech sound disabilities (Kent & Vorperian, 2018)

- Dialectical variation changes vowel acoustics (Fox & Jacewicz, 2009; Oder et al., 2013)

- Best practices in pediatric acoustic research currently involve manual processing for every token (Derdemezis et al., 2016; Vallabha & Tuller, 2002)
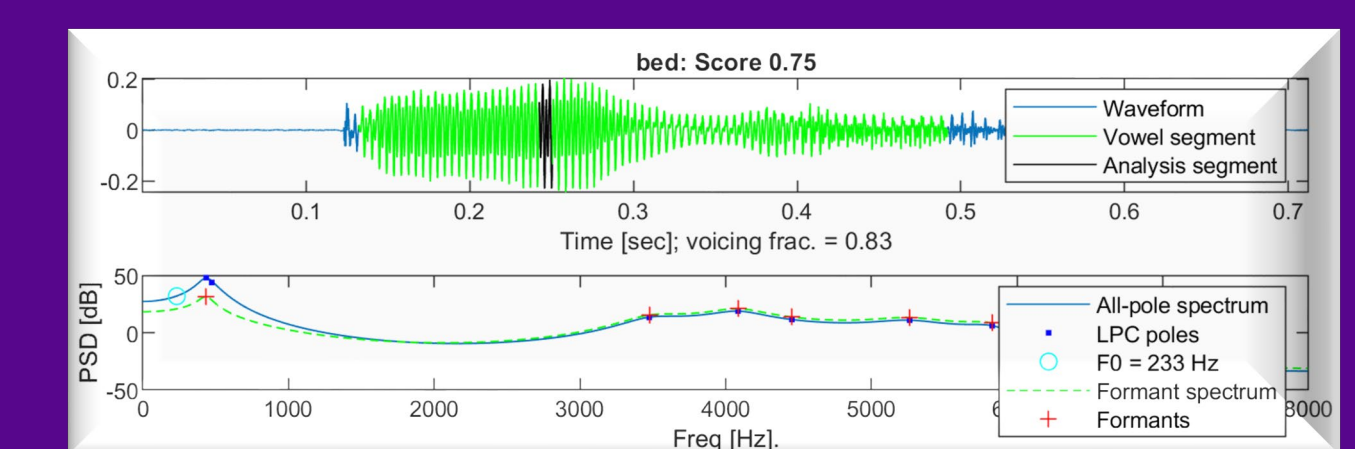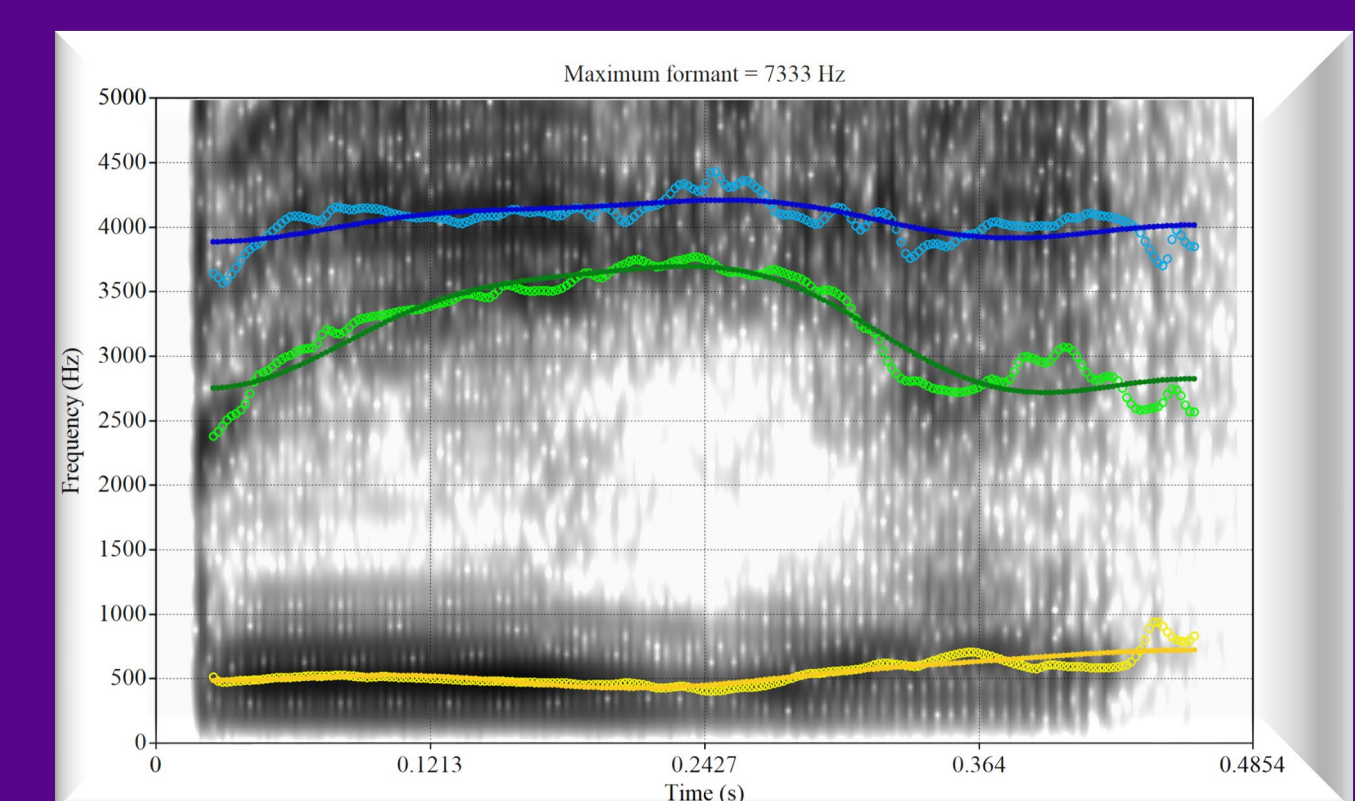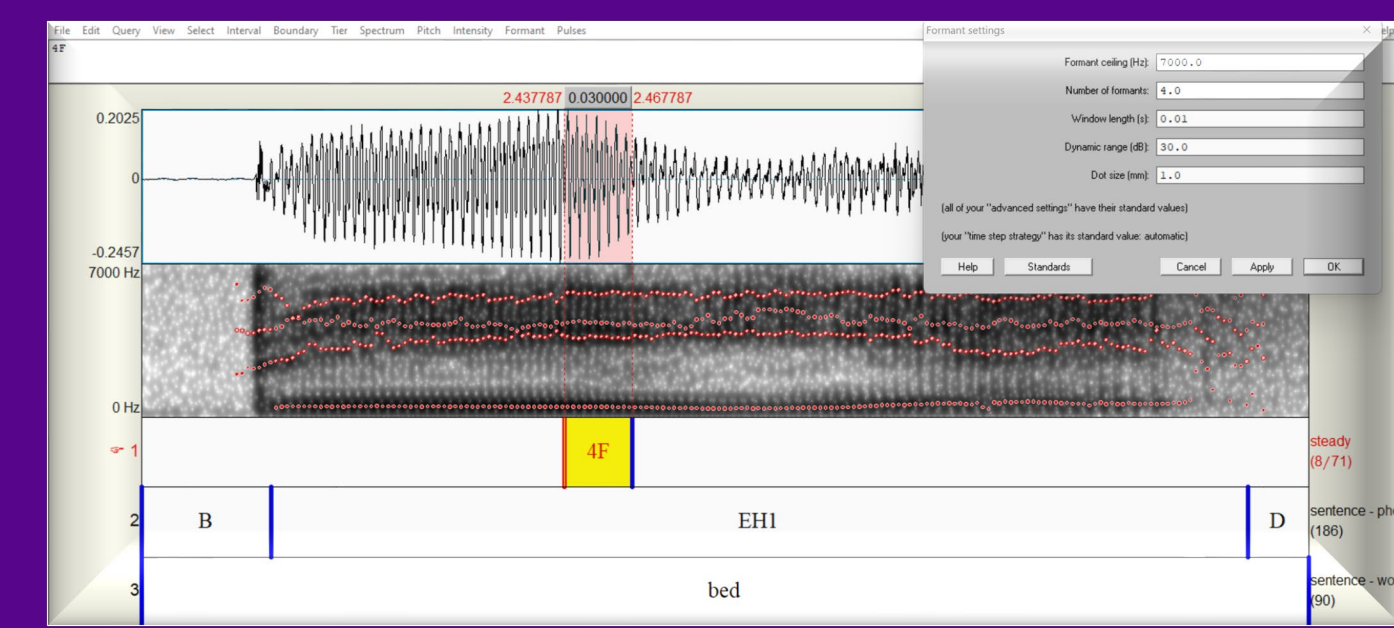
The Goal: Automation

- Automatic formant measurement means…
  - less reliance on biased auditory-perceptual measures
  - more data = (hopefully) more diverse data
  - future-proofing our field for the era of big data
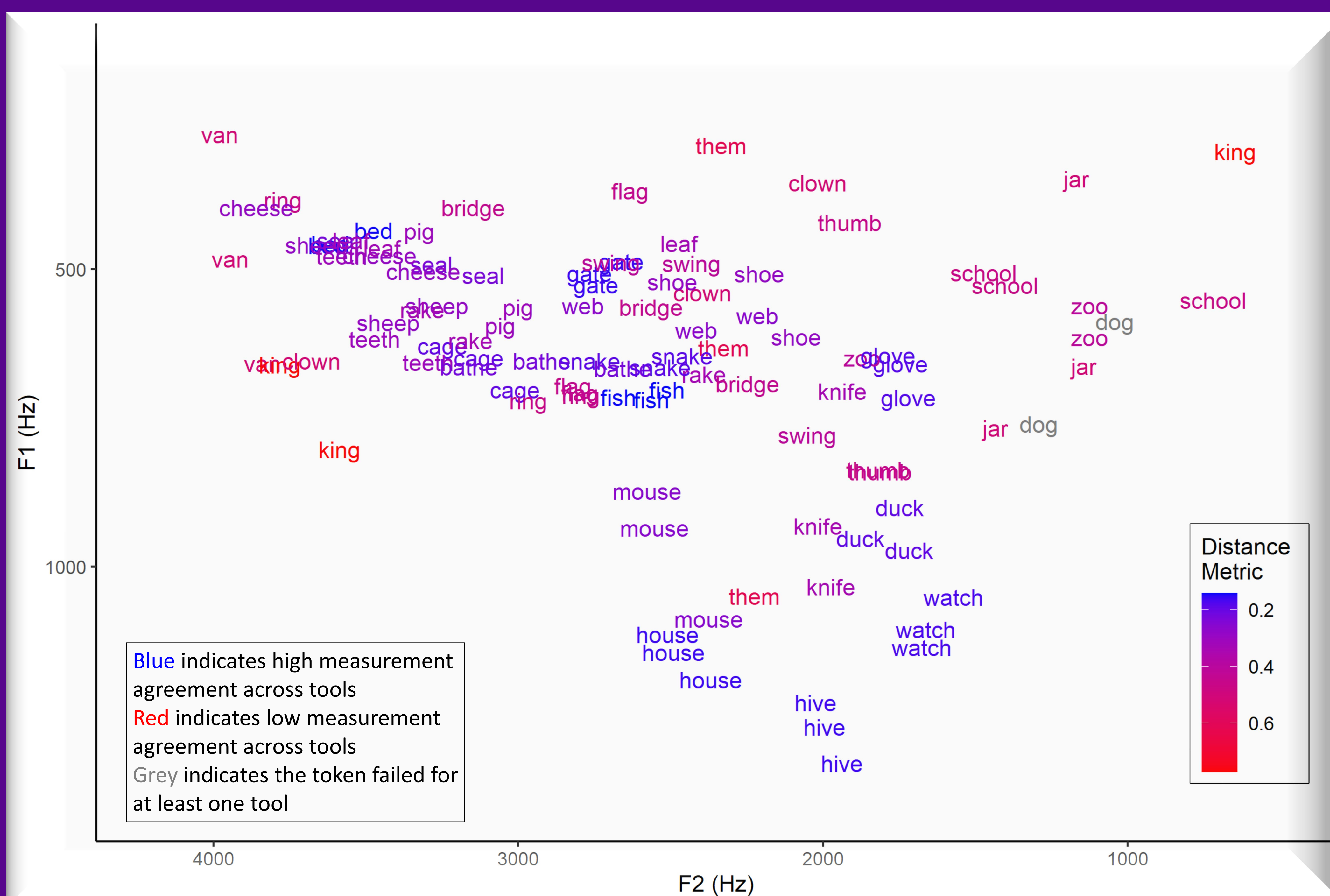 - more clinical relevance

The Speaker & Stimuli

- AFAB, age 5;2
- From a family that identifies as Black/African American
- Speaks Southern American English and African American English
- Has a speech sound disability
- 35 single-word recordings from the Speech Exemplar and Evaluation Database (SEED) (Speights et al., 2020)

The Tools

- Voweltine© (Valentine et al, 2022)
  - Runs in Praat
  - Developed for monophthong productions of children with speech sound disorders
  - Manipulates linear predictive coding filter order

- Fast Track© (Barreda, 2021)
  - Runs in Praat
  - Developed for adult speech
  - Manipulates linear predictive coding frequency ceiling

- SpeechMark® (Boyce et al., 2012)
  - Runs in MATLAB
  - Automatically identifies vowel segments
  - Developed for adults, children, and infants

The Results

Blue indicates high measurement agreement across tools
Red indicates low measurement agreement across tools
Grey indicates the token failed for at least one tool

Key Takeaways

- More tool validation is needed on diverse datasets!

- Before selecting an automation tool, users should consider…
  - Participant population
  - Vowel type
  - Data format
  - Research goals
  - Desired outcomes

- Extra care is needed with pediatric speech with linguistic variation

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