

# Individual differences in cue weights are correlated across contrasts

Meghan Clayards<sup>1,2</sup> & Sarah Colby<sup>2</sup>

meghan.clayards@mcgill.ca, sarah.colby@mail.mcgill.ca





## Background

- Individual differences (ID) in speech perception on many tasks
- Systematic for a given task over time
  - (Idemaru, Holt & Seltman, 2012; Strand et al. 2014; Yu & Lee, 2014)
- Cue weights are a measure of how much we attend to different acoustic phonetic dimensions for a particular contrast
  - (Holt & Lotto, 2003; Francis, Baldwin & Nusbaum, 2000)
- ID related to second language learning (Chandrasekaran et al., 2010) and cochlear implant use success (Moberly et al., 2014)
- VOT and f0 cues to stop voicing in English
  - correlated within individuals? (Schultz, Francis, & Llanos, 2012; Kong & Edwards, 2015)

# Central questions

How systematic are ID in cue weights across contrasts?

Do ID in cue weights relate to other aspects of speech perception?

## **Cue Weighting Task**

2AFC

2 cues varied orthogonally 5 steps x 5 steps

5 reps, 4 continua, 500 trials

	Cue A	Cue B
sock-shock	Vowel Transition	Frication Noise
bet-bat	Formant Frequency	Vowel Duration
bog-dog	Vowel Transition	Burst Amplitude

#### Stimuli

Step 1: Tandem STRAIGHT (Kawahara et al. 2008) continua from natural endpoints

Step 2:

sock-shock Frication portion removed and cross spliced

with vowel portion

Vowel duration manipulated with PSOLA in bet-bat

Praat (Boersma & Weenick, 2013)

Step 3: 5 steps x 5 steps chosen

### **Participants**

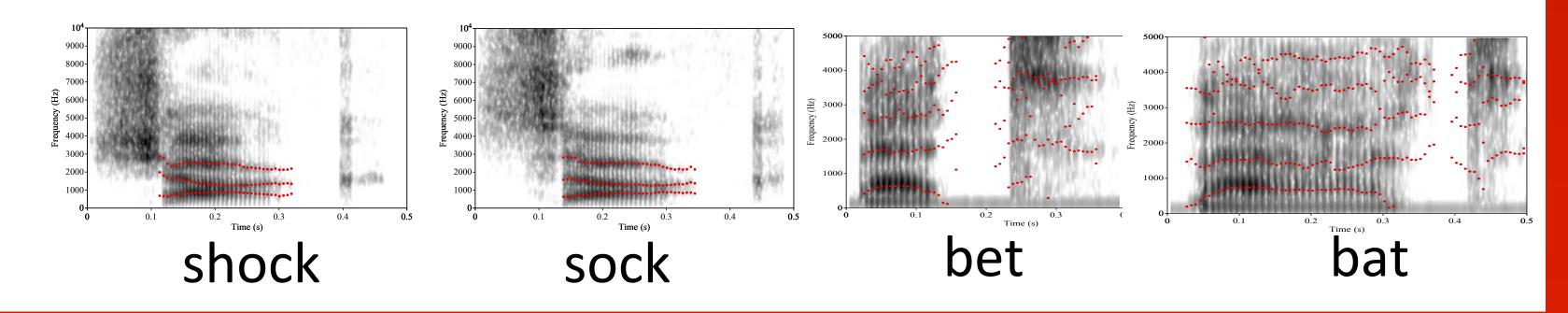
35 native English speakers

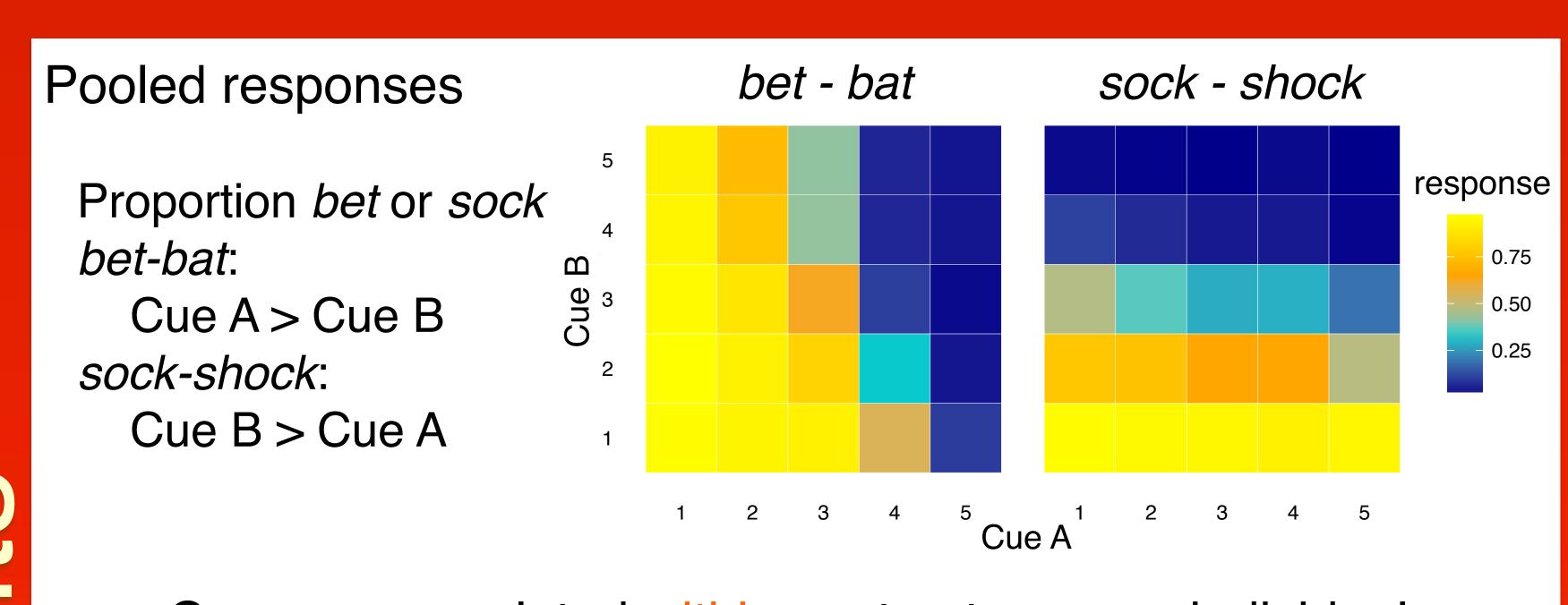
#### Analysis

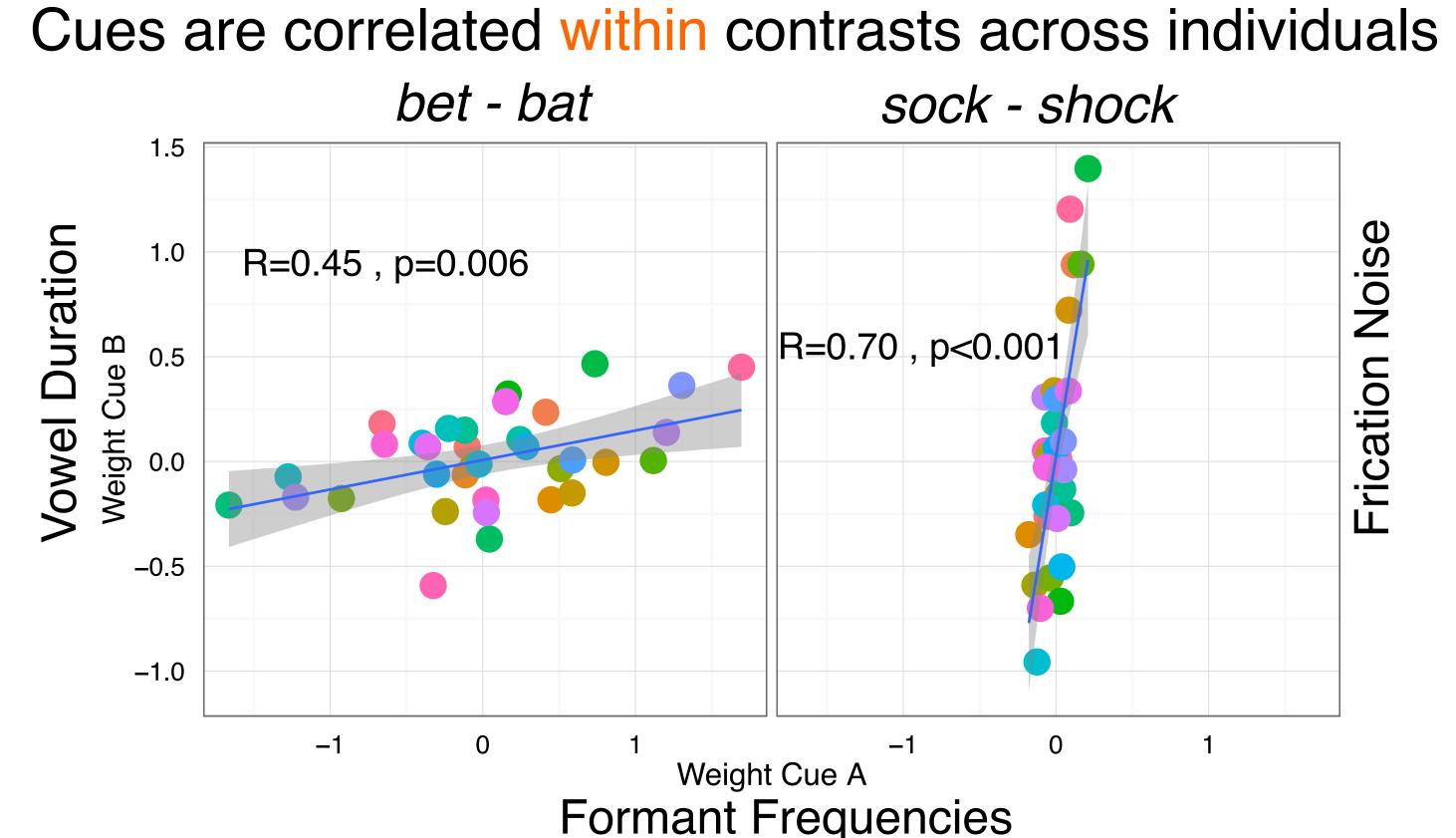
Mixed model logistic regression

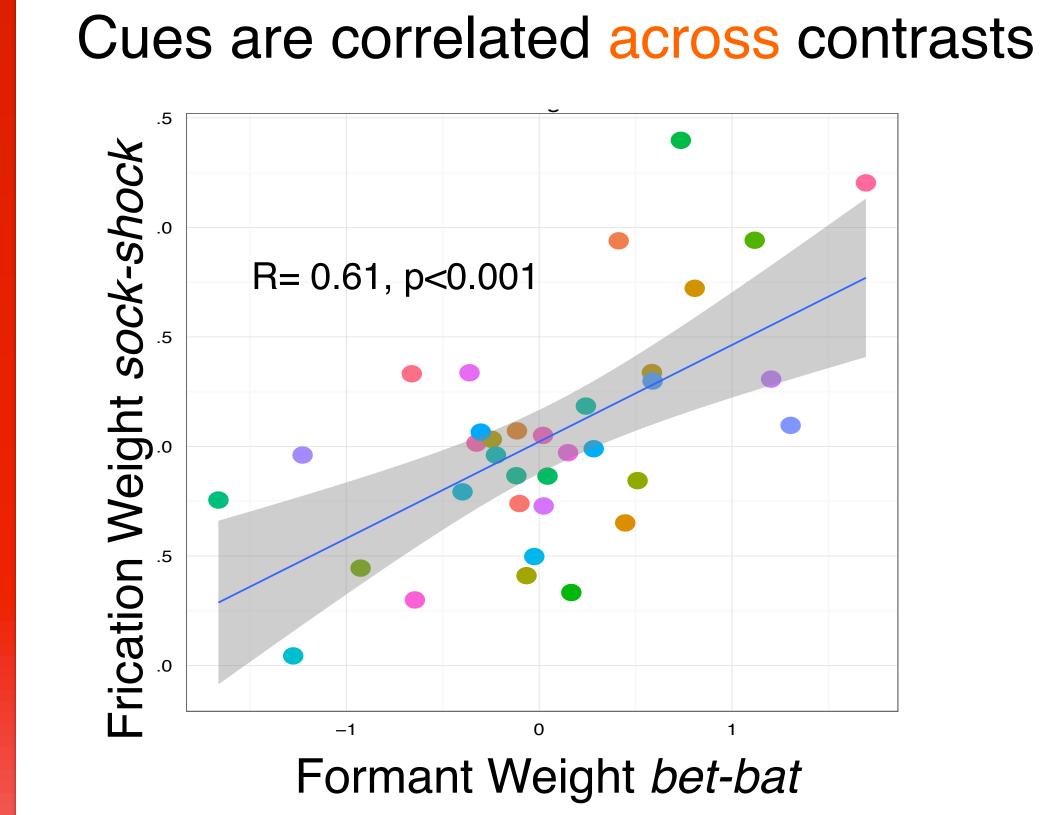
- One model per contrast
- Fixed effects of Cue A and Cue B
- Individual weights from random slopes for each cue by participant (deviations from the mean weight for the group shown. Model included a term for correlation between random slopes for the two cues)

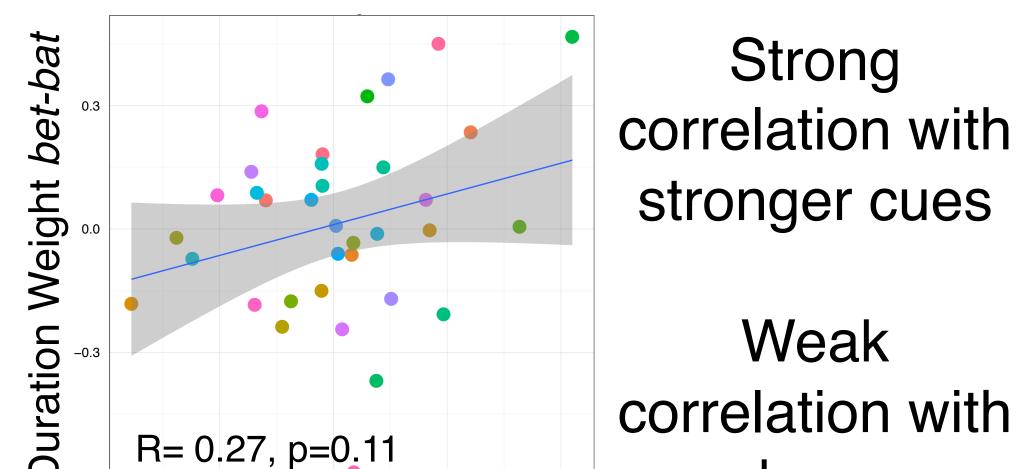
Pearson correlation on weights within and across contrasts



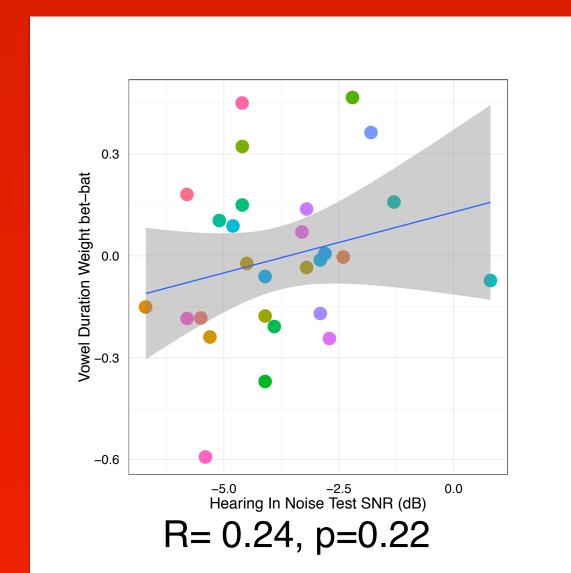


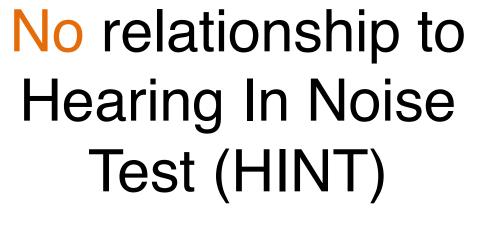


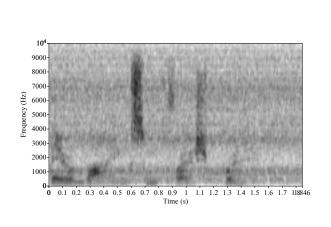


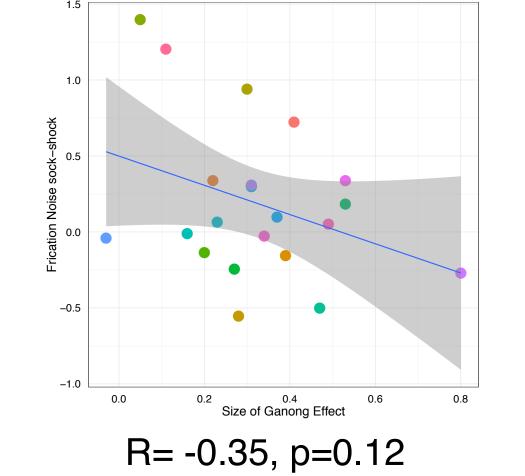


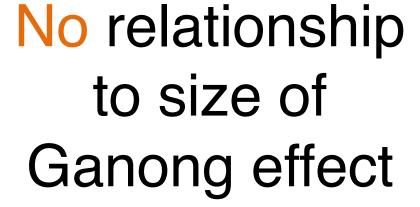
correlation with weaker cues Formant Weight sock-shock

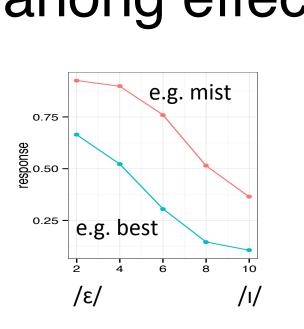












### Discussion

- ID in cue weights positively correlated within and across contrasts
  - However preliminary data finds negative correlation within bog-dog
- Some individuals are better able to use acoustic-phonetic information from the speech signal
- ID in cue weights not correlated with hearing in noise
  - may rely on different skills
- ID in cue weights not correlated with degree of lexical influence in 2AFC
  - Use of context is separate from ability to extract phonetic information

References: Chandrasekaran, B., Sampath, P. D., & Wong, P. C. (2010). Individual variability in cue-weighting and lexical tone learning. JASA, 128(1), 456-465. Francis, A. L., Baldwin, K., & Nusbaum, H. C. (2000). Effects of training on attention to acoustic cues. Perception & Psychophysics, 62(8), 1668-1680. Holt, L. L., & Lotto, A. J. (2006). Cue weighting in auditory categorization: Implications for first and second language acquisitiona). JASA, 119(5), 3059-3071. Idemaru, K., Holt, L. L., & Seltman, H. (2012). Individual differences in cue weights are stable across time: The case of Japanese stop lengths. JASA, 132(6), 3950-3964. Kong, E. J., & Edwards, J. (2015) Individual differences in L2 learners' perceptual cue weighting patterns. Proceedings of ICPhS, Glasgow, UK. Moberly, A. C., Lowenstein, J. H., Tarr, E., Caldwell-Tarr, A., Welling, D. B., Shahin, A. J., & Nittrouer, S. (2014). Do adults with normal hearing? JSLHR, 57(2), 566-582. Shultz, A. A., Francis, A. L., & Llanos, F. (2012). Differential cue weighting in perception and production of consonant voicing. JASA:EL, 132(2), EL95-EL101. Strand, J., Cooperman, A., Rowe, J., & Simenstad, A. (2014). Individual differences in susceptibility to the McGurk effect: Links with lipreading and detecting audiovisual incongruity. JSLHR, 57(6), 2322–2331. Yu, A. C. L., & Lee, H. (2014). The stability of perceptual compensation for coarticulation within and across individuals: A cross-validation study. JASA, 136(1), 382–388

This research was supported by SSHRC grant # 239255 to Meghan Clayards. The authors would like to thank David Fleischer and Melanie Oriana for help with data collection and Morgan Sonderegger for discussion of analysis (though he's not responsible for any analysis errors here).

