

## **Individual differences in perceptual cue weighting: behavioral, neurophysiological, and social considerations**

Alan Yu

*University of Chicago (USA)*  
aalyu@uchicago.edu

**Introduction:** Speech categories are defined by multiple acoustic dimensions and their boundaries are generally fuzzy and ambiguous. During speech perception, listeners must determine which cues are relevant and their relative importance. Despite an increasing number of studies documenting systematic and consistent variability in perceptual cue weighting across listeners within the same speech community (e.g., Clayards 2018, Idemaru et al 2012, Kong & Edwards 2016, Schertz et al 2015, Shultz et al. 2012), the processes underlying the variability remain largely underexplored. In this talk, I present results from two studies exploring the behavioral, neurophysiological, and social origins of individual variability in perceptual cue weighting.

**Study 1:** Recent studies suggest that individual differences in speech processing may stem from differences in the very early stages of speech processing (e.g., Kapnoula & McMurray 2021, Ou & Yu 2021). For example, the nature of VOT categorization among English speakers is found to correlate with how faithfully subcortical responses encode VOT differences, with listeners who showed more uncertainty in categorization exhibiting less faithful encoding of the acoustic differences (Ou & Yu 2021). The present study expands on Ou & Yu 2021 and investigated the role of subcortical encoding as a source of individual variability in cue weighting by focusing on English listeners' frequency following responses (FFR) to the tense/lax English vowel contrast varying in spectral and durational cues. We found that listeners differed in early auditory encoding with some encoding the spectral cue more veridically than the durational one, while others exhibited the reverse pattern. These differences in cue encoding further correlate with behavioral variability in cue weighting, suggesting that specificity in cue encoding across individuals modulates how cues are weighted in downstream processes.

**Study 2:** Previous studies have found that socio-indexical information influences how listeners process the speech signal (e.g., Strand 1999, Hay et al. 2006). This study investigates specifically how a listener's perception of a speaker's socio-indexical and personality characteristics influences the listener's perceptual cue weighting. In a matched-guise study, three groups of listeners classified a series of gender-neutral /b/-/p/ continua that vary in VOT and F0 at the onset of the following vowel. Listeners were assigned to one of three prompt conditions (i.e., a visually male talker, a visually female talker, or audio-only) and rated the talker in terms of vocal (and facial, in the visual prompt conditions) gender prototypicality, attractiveness, friendliness, confidence, trustworthiness, and gayness. Male listeners and listeners who saw a male face showed less reliance on VOT compared to listeners in the other conditions. Listeners' visual evaluation of the talker also affected their weighting of VOT and onset F0 cues, although the effects of facial impressions differ depending on the gender of the listener.

**Conclusions:** These findings highlight the fact that the mechanisms underlying individual variation in perceptual cue weightings are multi-dimensional. While listeners may show differential cue encoding, which then affects the reliability and weighting of certain cues that

support phonological contrasts, higher order indexical information may nonetheless influence how acoustic cues are utilized in speech processing. The significance of these findings for phonetic theories, theories of sound change, and the nature of phonological knowledge will be discussed.

## References

- Clayards, M. (2018). Differences in cue weights for speech perception are correlated for individuals within and across contrasts. *The Journal of the Acoustical Society of America* 144, EL172–EL177.
- Hay, J., Warren, P., and Drager, K. (2006). Factors influencing speech perception in the context of a merger-in-progress. *Journal of Phonetics*. 34, 458–484. doi: 10.1016/j.wocn.2005.10.001
- Idemaru, K., Holt, L. L., and Seltman, H. (2012). Individual differences in cue weight are stable across time: the case of Japanese stop lengths. *The Journal of the Acoustical Society of America* 132, 3950–3964. doi: 10.1121/1.4765076
- Kapnoula, E.C. & McMurray, B. (2021). Idiosyncratic use of bottom-up and top-down information leads to differences in speech perception flexibility: Converging evidence from ERPs and eye-tracking. *Brain and Language*, 223, 105031.
- Kong, E. J. & Edwards, J. (2016) Individual differences in categorical perception of speech: Cue weighting and executive function. *Journal of Phonetics* 59, 40–57.
- Ou, Jinghua and Alan C. L. Yu. (2021). Neural Correlates of Individual Differences in Speech Categorization: Evidence from Subcortical, Cortical, and Behavioral Measures. *Language, Cognition and Neuroscience*. <https://doi.org/10.1080/23273798.2021.1980594>
- Schertz, J., Cho, T., Lotto, A. & Warner, N. (2015) Individual differences in phonetic cue use in production and perception of a non-native sound contrast. *Journal of Phonetics* 52, 183–204.
- Shultz, A. A., Francis, A. L. & Llanos, F. (2012). Differential cue weighting in perception and production of consonant voicing. *The Journal of the Acoustical Society of America* 132, EL95–EL101.
- Strand, Elizabeth A. (1999). Uncovering the role of gender stereotypes in speech perception. *Journal of Language and Psychology* 18: 86-99.