Revisiting the notions of sound change actuation and phonologization

Introduction: Efforts in the past decades to identify variation in speech have provided important insights into a range of potential precursors of widely attested cross-linguistic sound changes. Yet, the nature of phonologization remains largely a mystery, that is, how does a phonetic precursor actuate as sound change? While sound change actuation is broadly conceptualized as the transition from a stage where a community of individuals exhibiting some form of intrinsic phonetic variations (i.e. the aforementioned phonetic precursors) to a stage where individuals within the same community exhibit extrinsic features of that particular contrast, it remains unclear how such a transition may come about.

This talk has two mains goals, one theoretical and one empirical. The broad theoretical goal is to argue for a reconceptualization of sound change actuation, and by extension, the notion of phonologization. To the extent that sound change is defined as systematic differences in pronunciation between individuals, I argue that the question of sound change actuation and phonologization is better addressed by asking how the processing and production of speech and language might vary across individuals in such a way that individuals who exhibit unique perceptual and production strategies relative to some community of practice may serve as innovators who can sustain the introduction of stable new phonetic variants. The empirical goal of this talk focuses on the nature of such individual variation. That is, is the observed individual variability due to differences in individual perceptual experience or the influence of some feature-general cognitive mechanism that modulates speech processing strategies?

The transition problem: Current phonologization models assume that communities transition from one stage to another. Here, rather than insisting on an antecedent relationship between individuals who exhibit intrinsic phonetic variations (to the extent that they can be discerned at all) and those who exhibit extrinsic variation, I submit that both types of individuals coexist within the same community of practice simultaneously. Intrinsic phonetic differences, in all likelihood, do not serve as models for innovation in general. Only individuals who have already attributed a given variation as extrinsically motivated (i.e. governed by linguistic knowledge, and not by first principles from physics, physiology, and auditory perception) can provide a consistent and persistent enough reification of a novel variant for it to propagate. The transition problem evaporates under this conception of sound change actuation since a sound change is actuated whenever a person developed a phonological understanding of a variable pattern.

Toward the origins of individual differences: To the extent that sound change results from how individuals might vary in how they analyze the linguistic signal, sound change actuation research should focus on identifying the mechanism(s) underpinning of such variation. Variability may stem from differences in individual perceptual experience or the influence of some feature-general cognitive mechanism that modulates speech processing strategies. The experiment described below examines the relationship between perceptual behaviors across three categorization tasks concerning three sets of phonological contrasts in English (i.e. the effects of VOT and f0 on voicing identification, the effects of spectral and duration information on i/ɪ identification, and the effects of vowel on sibilant identification). If individual variability stems from feature-general cognitive mechanism, we expect perceptual behaviors across three tasks to

be correlated within individual; no such prediction is expected if individual variability stems from feature-specific experiences.
Methods: 108 participants (55 females; median age = 30, range = 18-63), recruited on MechanicalTurk, completed three categorization tasks. One task asked the participants to classify two 7-step VOT continua ranging from /pa/ to /ba/ with an f0 offset that is either 100 Hz or 180 Hz as having beginning with "p" or "b". In another task participants listened to two 7-step /i/-to-/ɪ/ continua where the vowel is either 50 ms or 300 ms long and decided if the vowel is "ih" or "ee". In the third task, listeners decided if the sibilant is "s" or "sh" when listening to two 7-step /s/-to-/ʃ/ continua where the context vowel is either /a/ or /u/. Each set of stimuli was presented in seven blocks and the order of stimuli was randomized within block. Results of each task were modeled using mixed effects logistic regressions with a contextual predictor (f0, vowel duration, or vowel quality), continuum step (1-7), and the interaction between the two, as fixed predictors and by-subject random intercepts as well as by-subject random slopes for each predictor. Conditional estimates of the random slopes for each subject were submitted to a *k*-means clustering analysis using *NbClust* (Charrad et al. 2014) in R to identify clustering among participants in perceptual behaviors.

Results: Cluster analysis reveals two groups of individuals. A series of Kruskal-Wallis tests shows significant group differences in the by-subject slopes for Continuum Step for all three tasks. Individuals in Group 1 (N=42) exhibit shallower classification functions, suggesting that they were less categorical (i.e. more gradient) in their categorization responses than individuals in Group 2. There is also a group difference in the effects of f0 on voicing identification and of vowel duration on i/ɪ identification, suggesting that Group 1 individuals, who exhibit more gradient response patterns, are also more reliant on secondary cues such as f0 for voicing and vowel duration for i/ɪ.

Discussion: The present findings show that listeners differ in their categorization tendencies. Some individuals exhibit consistent gradient response patterns in both cue weighting and perceptual compensation tasks, while others are consistently more categorical. While these findings are consistent with recent studies which point to categorization gradiency as a predictor of individual differences in reliance on secondary cues in phonetic categorization (Kong & Edward 2011, 2016 & Kapnoula 2016), how categorization gradience relates to individual variation in perceptual compensation for coarticulation remains unclear. I will end with some speculations on what individual differences in categorization gradience might tell us about the cognitive and social profiles of individuals.