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In situ perspectives on retraction- Austinites on Troublemaker Shtreet

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Within a language community where both the norms of Texan English and African American Vernacular English are still distinct and strongly recognized both by insiders and outsiders of these dialects, a shared phonological variable with little to no recognition amongst speakers may be surprising. Nonetheless, the retraction of /s/ in consonant clusters (as in *shtreet* versus street) appears to present with the described pattern in the city of Austin.

This phenomenon was first recognized by Labov (1984), and later analyzed with regard to phonological processes by Shapiro (1995), Lawrence (2000), Durian (2006) and Rutter (2011). Studies ranging from Ohio (Durian) down to Louisiana (Rutter) and over to Philadelphia (Gylfadottir) indicate a non-regional phenomenon, as first assumed by Shapiro. Gylfadottir (2015) however was one of the first to attempt an evaluation of the phenomenon beyond the phonological scope. She used a corpus-based analysis to show a change in progress for the phenomenon in Philadelphia. The current study aims at providing an Austin-based perspective on the progression of change. Furthermore it evaluates ethnicity as a possible factor. A qualitative analysis of the interviews will extend the knowledge about the metalinguistic trends mentioned by Hinrichs et. al.(2015) in their blog analysis.

Methodologically, the present study used a sociolinguistic interview guised as a memory test with visual and textual input. It was carried out in the everyday environment of speakers, granting natural speech production in one-word answers, a reading section and a concluding content interview. The debriefing process was then used to elicit metalinguistic data on the phenomenon of /s/-retraction.

Interview recordings were force-aligned with hand-corrected DARLA (DARLA (Reddy & Stanford 2015), using Prosodylab-Aligner (Gorman et al. 2011), FAVE-Extract (Rosenfelder et al. 2014), and the Vowels R package (Kendall & Thomas 2010) scripts to then perform an automated identification and center-of-gravity measurement of all tokens of pre-vocalic /s/-consonant clusters in Praat. Tokens of /s/ and /ʃ/ were also identified for each speaker as individual baseline, which was then used to normalize the range of variation between both sibilants in cluster-tokens. Mixed-effects linear-regression models were applied to both social and linguistic factors. While the lack of a gender-effect and the existence of retraction amongst all age groups negate a clear interpretation of this variation as change in apparent time, ethnicity appears to have become a less important factor in recent years, while the phenomenon itself seems to be rooted in AAVE.

The qualitative analysis furthermore reveals that retraction is below the level of consciousness for all speakers. While /ʃ/ is actively used as an allophone in the clustered environment by only a third of the speakers, meta commentary presents its general perception as indistinguishable from /s/, which cannot be understood from the quantitative findings in this and other studies. This shows an interesting view on the difference between intraspeaker and interspeaker variation, where subjects readily acknowledge variability amongst their community but are unable to judge their own production of sounds. Neuroscience has shown that feedback mechanisms are in place to alter production based on perception of outcome (Zheng et. al. 2010). Where output (own speech) and input (community patterns) remain uncorrected, a sound may fluctuate in the communal “sibilant space”. Discrepancies between perception and production as well as some fluctuation are already well documented in vowels (Boersma & Chládková 2011).

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Speaker variability in cue weighting for laryngeal contrasts: the relationship to sound change

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Introduction: Recent studies on a tonogenetic sound change in progress in Seoul Korean (Kang, 2014; Authors, 2015), where f0 is replacing VOT as the primary cue for distinguishing two stop series, finds a tight inverse relationship between the enhancement of f0 and reduction of VOT across speakers, words (of different frequencies), and phonetic contexts (following vowel heights). These findings suggest that the sound change is propagating across speakers and the language itself in an adaptive manner, driven by a combination of production bias (i.e. reduction) in one dimension (VOT), and adaptive expansion in another dimension (f0), plausibly to avoid merger. However, it is not clear to what extent this parallelism (decreased VOT use ~ increased f0 use) is expected cross-linguistically, or it is a unique characteristic of a language undergoing tonogenesis. Recent studies have examined the relative weighting of VOT and f0 across speakers in the context of laryngeal contrasts in several languages (Shultz et al., 2013; Kirby, 2016). These studies found a trading relation across speakers, consistently in languages that have long-lag stops. However, we are not aware of any studies addressing VOT and f0 contrast tradeoff across words (e.g. frequency) or contexts (e.g. vowel height). This study examines data from three languages to understand whether the parallelism between VOT and f0 observed in Korean across speakers/words/contexts is present cross-linguistically (and thus a possible *cause* of transphonologization), versus a *consequence* of the sound change in progress.

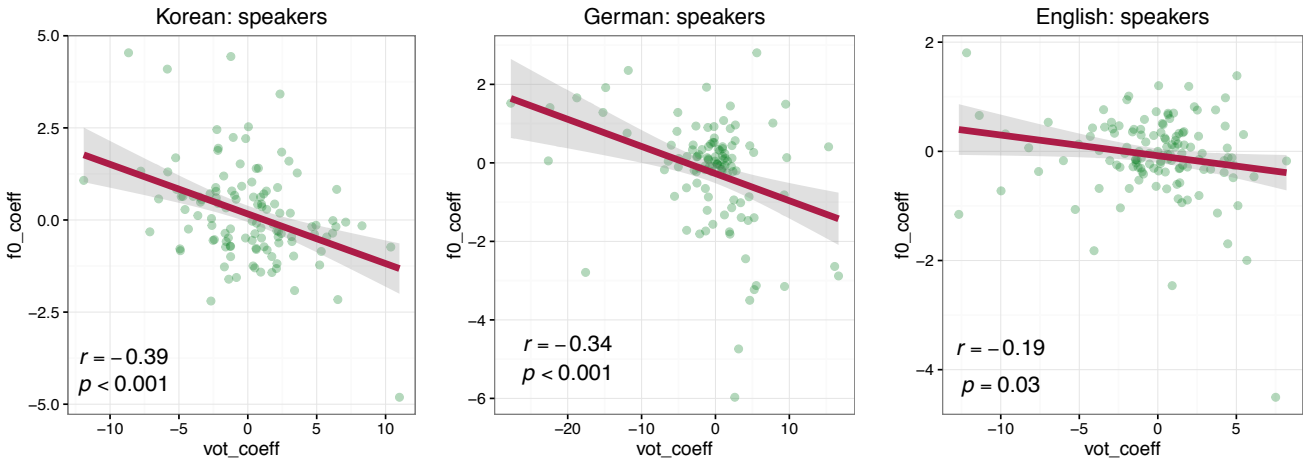
Analysis 1: First, we examined whether covariance between VOT and f0 occurs across speakers and words by examining the size of the fortis/lenis contrast in German, using speech from 118 speakers and 76 word items in the PhonDat corpus (n=2573) (Draxler, 1995); and in English, using 126 speakers and 76 word items in the WPC G3 corpus (n=4208) (Morgan et al., 2005). For both languages, raw f0 values were taken at 10ms after the first glottalic cycle and were converted into semitones relative each talker's mean f0. The results are compared with the results from Seoul Korean in our previous study (NIKL, 2005: 118 speakers, 81 words, n=7916) (Bang et al., 2015).

The results show that in German, the size of the VOT contrast is affected by speaker gender, word frequency, and vowel height–similarly to Korean, while f0 is only affected by gender unlike the parallelism observed in Korean. In English, the results show that the size of VOT is unaffected by any of the variables, while the size of f0 was affected by gender and vowel height.

Analysis 2: We further investigated whether VOT/f0 covariance would be observed across speakers in each of three languages, by first partialing out linguistic factors affecting VOT/f0, and then estimating cue weights for each speaker (using logistic regression) for VOT and f0 as cues to the fortis/lenis (aspirated/lax for Korean) contrast for. The relative weights of the two cues in production, across speakers, is shown for each language in Figure 1. Even though the strength of correlations varies across languages, statistically significant correlations were found in all languages. Crucially, the strongest correlation was found in Seoul Korean (r=-0.39, p< .001), consistent with the change progressing at the community level. A strong correlation was also found in German (r=-0.34, p <.001) while a relatively weak correlation was observed in English (r=-0.19, p< .03). Our results show that the cue weights of F0 and VOT are negatively correlated across speakers in all languages but the parallelism exists across words and contexts only in the language undergoing sound change.

Discussion: One possible interpretation of our results is that VOT/f0 covariation across speakers, which appears to hold across languages, may be a cause of tonogenetic sound change (e.g. if speakers with higher f0 weight initiate change: Baker et al., 2011), while covariation across words and contexts may be a consequence of it. This interim conclusion, based on 3 languages, requires confirmation by further studies, across languages that differ in the number of contrasts, the existence of true (phonetic) voicing, and the structure of tonal systems.

Figure 1. Scatterplots showing by-talker logistic regression weights for VOT and normalized F0 in each language performed on the residuals after partialing out linguistic factors affecting VOT/f0 (Pearson's correlation (*r*) coefficients and *p*-values are provided).



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Are innovative listeners also innovative speakers?
The time course of individuals' perception and production of coarticulatory information

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Individual listeners differentially attend to the multiple, co-occurring properties that distinguish speech contrasts (e.g., [4], [7], [8]). Arguments for listener-initiated sound changes often assume that this selective perceptual attention is mirrored in each individual's own productions ([6], [9] among many others). In this view, a listener's potentially innovative perceptual weights are publicly manifested through that listener-turned-speaker's productions.

This study tests, for coarticulatory vowel nasalization in American English, whether individuals' perception and production repertoires are linked in this way. We hypothesize that listeners who closely attend to the coarticulatory information will, as speakers, consistently, and possibly more extensively, produce that information in their own speech. Our approach differs from previous coarticulatory studies of the perception-production relation ([2], [3], [5]) in investigating the moment-by-moment processing and production of coarticulation.

Perception and production were assessed for 43 participants using eye-tracking and airflow methods. The perception study replicated [1]. In each trial of interest here, the visual stimulus was paired images of CVC-CVNC words (e.g., *bet-bent*); the auditory stimulus was the target CV(N)C word. To test listeners' close attention to coarticulation, each original CVNC was edited to create two nasalization patterns, early (80% nasal) and late (40%) onset. In production, oral and nasal airflow was captured as participants identified aloud the name and placement of one of the two paired images from the eye-tracking study ("*bent* is on the left."). The perceptual measure was proportion correct fixations over time; production measured raw nasal flow over time.

Linear Mixed Effects models were used to model elements of the production and perception data. Model results showed the expected differences, over time, in airflow patterns for oral (CVC) vs. nasal (CVNC) vowels and in eye-tracking patterns for the two vowel nasalization conditions (i.e., earlier CVNC fixation for early onset vowel nasalization). Of particular importance is that comparison of models with and without a random effect of participant revealed a significant improvement in fit in the production and perception models with participant included, pointing to substantial inter-participant variation in producing and perceiving nasalization ($p < 0.001$).

To assess the relation between individuals' perception and production, we aggregated nasal airflow across the production data by participant to characterize each speaker's flow pattern. These aggregate curves were subjected to principal component analysis to isolate meaningful components in the flow patterns. The PC that best captured the time-varying properties (PC2) was entered into the perception model. As a conventional LMER model did not converge when including the Time*Nasalization*PC2 interaction, we used MCMCglmm to fit a GLMM using Markov Chain Monte Carlo techniques. The relevant interaction, Time (modeled as a b-spline with df = 3)*PC2, reached significance ($p < 0.001$) in the basis function modeling the central portion of vowel, indicating that participants with high PC2 flow patterns had, in perception, a higher proportion looks to CVNC during the nasalized portion of the vowel (Fig. 1). This relation is illustrated for 10 individuals: Fig. 2 gives the aggregate airflow traces for the speakers with the highest (grey) and lowest (black) PC2 values; Fig. 3 shows these same individuals' proportion correct fixations of CVNC images over time. Individuals who produce especially early onset of anticipatory nasalization track this coarticulatory property particularly closely in perception.

In this study, listeners' perceptual weights—here, their early use of coarticulatory information as the acoustic signal unfolds—appear to be publicly manifested in these individuals' coarticulated productions. Although the current data presumably do not tap into a change in progress, they provide support for the hypothesis that innovative listeners (e.g., listeners who weight the effects of coarticulation more than their source) are also innovative speakers.

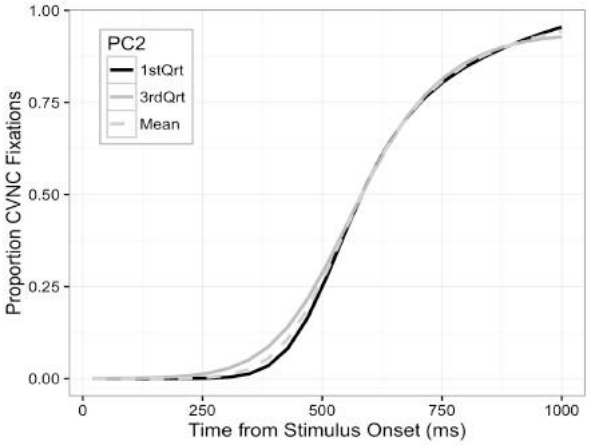

Fig. 1. MCMCglmm model predictions of CVNC fixations over time for hypothetical speakers with airflow-based PC2 scores at the mean and 1st and 3rd Quartiles. Main region of interest is the nasalized portion of the vowel, spanning 300-420 ms from stimulus onset (adjusting for roughly 200 ms to program an eye movement).

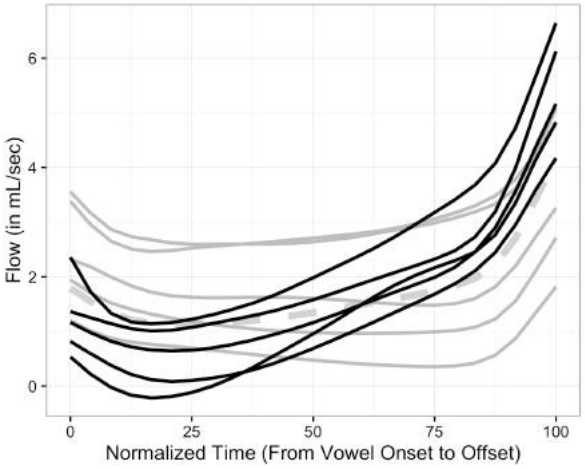

Fig. 2. Production: Raw nasal airflow (across the vowel) of 10 participants: 5 with highest PC2 values (grey lines) and 5 with low lowest (black). Dotted line: mean PC2.

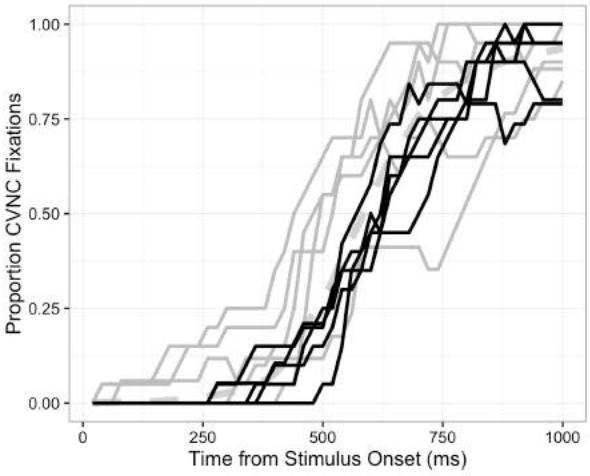

Fig. 3. Perception: Proportion CVNC fixations of the 10 participants in Fig. 2. Grey & black lines: fixations of participants with highest & lowest PC2, respectively. Dotted: mean proportion fixations.

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Dual mechanisms of cognitive control modulate the integration of phonological variation

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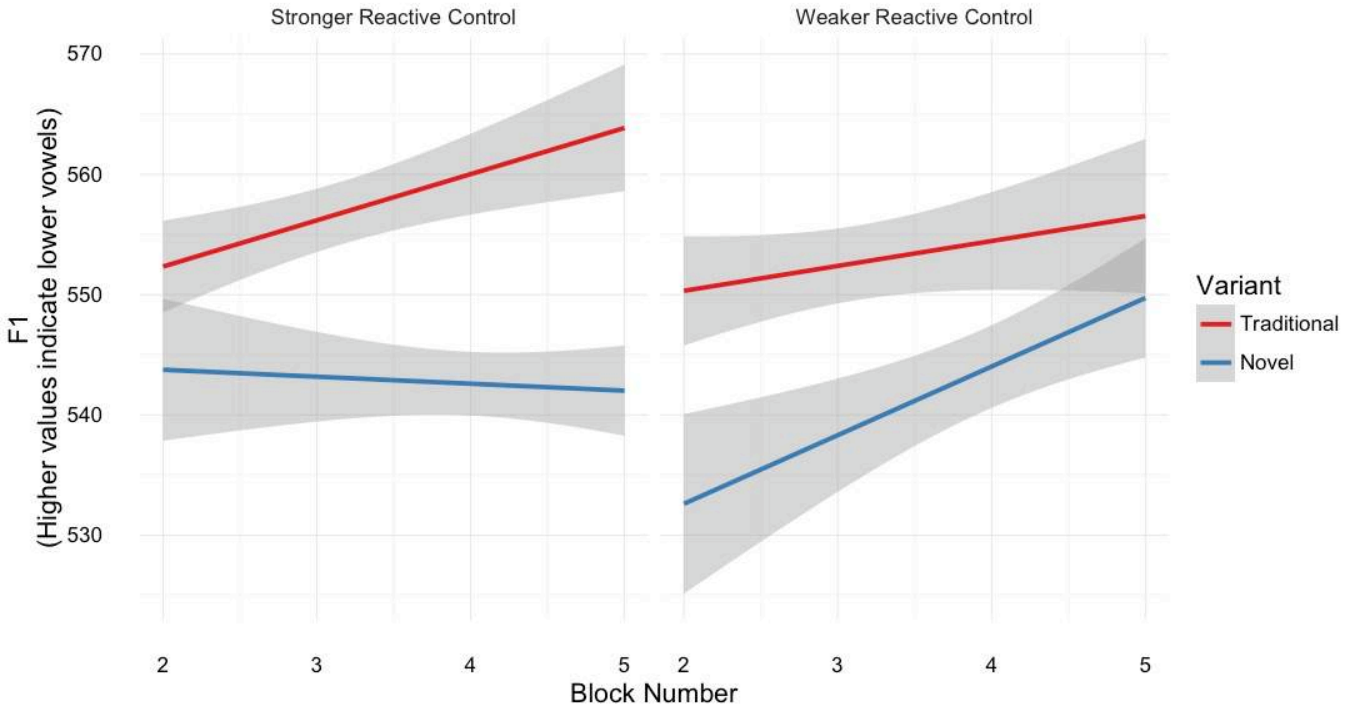
To adapt to phonological variation and participate in language changes-in-progress, individuals must integrate changes in distributional frequencies from their input into their own production. A key mechanism that may influence the rate at which new variants are incorporated is cognitive control. Evidence suggests that individuals with lower cognitive control may be more strongly influenced by phonological competition, both within a single language (Lev-Ari and Peperkamp 2014) and across two languages stored in a single mind (Lev-Ari and Peperkamp 2013). Over time, this may result in individuals with weaker cognitive control being more strongly influenced by variation in their linguistic environment.

According to the Dual Mechanisms of Control account (DMC; e.g., Braver et al. 2007), cognitive control can be subdivided into two semi-independent processing modes. The first, proactive control, relates to the ability to hold cues or rules in memory, and these bias processing while active. The second, reactive control, refers to one's ability to quickly react to unexpected input. Nearly no work to date has investigated the influence of DMC on language processing (but see Ye and Zhou [2009] for a review of executive function in language processing more generally), but proactive control is hypothesized to correlate to one's tendency to focus on context when processing linguistic variation (Berry 2016). Individuals with weaker proactive control, who have less skill engaging top-down mechanisms to influence processing, may be more likely to rely on contextualized variation in their input, which may advance their integration of that variation. Similarly, individuals with weaker reactive mechanisms are hypothesized to be less likely to correct for unexpected variants present in their input, which may increase the likelihood that phonological variation will affect their future production.

The current study explores the influence of dual mechanisms of cognitive control (cf. Braver et al. 2007; Braver 2012) on adaptation to phonological variation in the context of simulated sound change in the laboratory. Stimuli consisted of 80 mono- and bisyllabic words controlled for lexical frequency using CLEARPOND (Marian et al. 2012); half were targets with /ɪ/ as the stressed vowel. Of the targets, half preceded a voiceless coronal coda (e.g., /t/); this was arbitrarily determined to be a favorable context for lowering of /ɪ/ to /ɛ/. A model talker recorded all stimuli, including variants of favorable tokens with the novel /ɛ/ vowel (e.g., "pitch" as both /pɪtʃ/ and /pɛtʃ/). Monolingual English participants (n=35) read these words aloud, and then alternated between hearing the model talker produce these words and producing the stimuli themselves. Crucially, the number of "favorable" stimuli spoken by the model talker with the novel variant increased systematically with each exposure block, permitting an analysis of how changes in distributional frequencies in input influence the integration of those changes in subsequent production.

The height of participants' target /ɪ/ vowels (measured as F1) was analyzed by variant category present in the exposure stimulus (traditional /ɪ/, or novel /ɛ/), block, and measures of proactive and reactive control derived from the AX-CPT task (e.g., Braver et al. 2007; Berry 2016) using mixed effects regression in R (Bates et al. 2015; R Core Group 2016). There was a main effect of variant, suggesting that individuals produced stimuli they had heard with the novel /ɛ/ variant higher than those in which they heard the traditional /ɪ/ variant ($t = -2.45$). Nonetheless, an interaction between block and variant indicated that individuals adapted to the simulated sound change, lowering their vowels in the novel stimuli over time ($t = 2.49$). What is more, a three-way interaction between reactive control, block, and variant suggested that individuals with lower reactive control adapted their production of stimuli with the novel variant more quickly and to a higher degree than those with stronger reactive control ($t = -3.01$; see Figure 1). No significant effects were found for proactive control in the current dataset. These results are considered in light of other hypotheses on cognitive factors in the actuation of sound change (e.g., Yu 2010), and situated in a theoretical framework where habitual engagement of specific cognitive control modes over time may modulate perception, subsequent production, and participation in sound change.

Figure 1: Changes in vowel height by block, variant, and reactive control



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Mergers-in-Progress in Cantonese-English Bilinguals

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As early as the 1940's, linguists have documented phonetic variation in certain syllable-initial and syllable-final consonants in Hong Kong Cantonese (eg. Zee, 1999).This variation has led to a set of mergers-in-progress. To, Mcleod, & Cheung (2015) examined the progression of these sound changes in Hong Kong, concluding that several of the variations in syllable-initial or syllabic contexts were nearing completion, including [n-] →[l-], [ŋ-] → [Ø-], [Ø-] → [ŋ-] and [n̩] →[m̩]. While there are no consistently reported gender differences in these sound change, [l-], [Ø-] and [m̩] are described as more likely to be used by younger speakers, but [ŋ-] was more commonly used by older speakers.

Several of these sound changes lead to an increased similarity between the Cantonese and English phonological systems. In Hong Kong, many speakers have at least some experience with English, but most are dominant in Cantonese. In contrast, Vancouver is a Canadian city where there is a sizable Cantonese-speaking population, including both first generation immigrants and heritage speakers. Heritage speakers, who learn Cantonese in the home, constitute a highly heterogeneous group where language experiences and levels of bilingual proficiency vary widely (Benmamoun, Montrul & Polinsky, 2013; Kupisch, 2013); however, they tend to be largely dominant in the societal majority language - which, in this case, is English. Previous literature indicates that bilingual speakers show phonetic influences in both directions between their two languages (Flege, 1987), but that there are differences in these effects across native speakers, heritage speakers, and late L2 learners (Chang, Yao, Haynes & Rhodes, 2011). The aim of this current study is to investigate the state of a subset of the Hong Kong Cantonese syllable-initial mergers ([n-]→[l-], [ŋ-]↔[Ø-], [n̩]→[m̩]) in Hong Kong-based and Vancouver-based Cantonese speakers, focusing on the possibility of bilingual influence from English as a driving factor in the progress of the merger. Participants include four groups of Cantonese-English bilinguals with varying levels of bilingual dominance: (i) younger (heritage) and (ii) older (immigrant) generations of speakers from Vancouver, and (iii and iv) age-matched groups from Hong Kong.

Following the perception and production approach of Harrington et al. (2008), we examine the mergers-in-progress in both of these domains. In the perception experiment, participants heard three sets of Cantonese minimal word-pair continua, each corresponding to one of the target contrasts, and their task was to decide what word they heard. In the production experiment, participants were prompted with both Chinese characters and the English translation to say 20 isolated Cantonese words containing the target contrasts. Language background information was collected, and bilingual dominance scores were calculated using the Bilingual Language Profile (Birdsong, Gertken & Amengual, 2012). Data collection is ongoing. However, regardless of the specific results, this study will contribute to our understanding about heritage speakers and the course of sound change in immigrant populations, as well as how bilingual language transfer may motivate phonetic change.

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"*C'est ton ami ou ton amie ?*" A sociolinguistic explanation of the loss of inflectional-induced quantity opposition in modern French.

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Standard French does not display any contrast based on vowel length. However, the reduction and fall of final /ə/ and /s/ (realisations of the inflectional morphemes for feminine and plural) in nouns, adjectives and past participles in pre-classical French led to the emergence of quantitative oppositions. Those were common in most of the oïl dialects, although inconstantly; for instance, speakers in Normandy would discriminate *ami* (short /i/) and *amie/amis/amies* (long /i:/), speakers in the French-speaking part of Brittany would only have a gender-based opposition (*ami/amis* vs. *amie/amies*) whereas speakers in Picardy would not lengthen in any case.

It is well established that modern standard French derives from the 18th century Parisian accent. It is also known from many grammarians that throughout the 17th and most of the 18th century, quantity oppositions were the norm in Parisian French inflectional morphology, and that they were considered outdated and *provincial* from the late 18th century onwards. What happened in such a short period of time in greater Paris for vowel length alternations to disappear?

During this pre-industrial time the French capital city would already attract people from across France, mostly from the northern half of the country. Those were also times of great political instability, with the King moving out to Versailles and losing his normative power on Paris, and the creation and rise of the very Parisian institution of the *Académie Française*. Therefore, the variety of French spoken in Paris was suddenly free and encouraged to evolve, at a time when people from different linguistic backgrounds and different oppositions of vowel length, but also some from further away who mostly spoke non-quantity languages (such as Breton or Occitan), massively moved to Paris.

Following Trudgill's approach to linguistic change resulting from dialect contact, we compare the fall of quantitative oppositions in Parisian French with his own example of the disappearance of the second-person pronoun forms *thou/thee/thy/thine* in London at the same period of time, as Britain's capital city underwent a similar social and linguistic mixing during the 18th century. We offer an explanation of this phenomenon based on levelling and simplifying: from a dialect contact perspective, the potential confusion between short and long vowels as well the absence of such a contrast in many incomers' phonemic systems may well be responsible for the extremely quick elimination of this feature of Classical French.

We will also expose the extremely quick expansion of the new Parisian norm after the Revolution through mass education and through the media, and we will touch upon the remaining length-based contrasts in nowadays peripherical dialects such as Bourguignon and Normand.

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The role of fast speech in sound change

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Amid a growing interest in the role of individual traits in sound change,[1][2][3] few studies focus on the role of consistently fast speakers in sound change. Fast speech is often taken as a typical condition promoting the likelihood of lenition.[4][5][6] Does this mean that typically fast speakers drive sound change processes? Is fast speech an individual trait? We used corpus studies to investigate the impact of fast speakers and fast speech on non-phonologized oral stop deletion, a well-known lenition process.[7]

Study 1 used the Switchboard Corpus[8] to validate the view that speech rate is an individual trait. We defined *expected duration* as the prediction of a linear regression that combined mean word duration, contextual predictability, and frequency. *Pointwise speech rate* was defined as the actual duration of a word instance, divided by its expected duration (high pointwise speech rate indicates *slow* articulation). Speakers' conversational speech rates were then calculated as the geometric mean of the pointwise speech rates of all content words in each conversation. Consistency was established in a mixed effects linear regression using 4750 conversations that predicted a speaker's conversational speech rate using the average of that speaker's speech rate in all other conversations in which they participated, the interlocutor's speech rate in all other conversations, and the age and gender of both conversants. Speakers and interlocutors were random intercepts. All speech rate variables were logged and normalized. The speaker's speech rate in other conversations was extremely predictive of actual speech rate and was the most predictive variable (**β=0.79**, SE=0.0092, t=86.416, $p<10^{-30}$) by an order of magnitude. Speakers can thus be expected to be consistent in their speech rate across conversations.

For Study 2, we used the Buckeye Corpus[9] to study the effect of speech rate on oral stop deletion. Following established procedure,[10] phonemes were linked to their output forms using a weighted edit-distance program. Words that occurred less than 4 times in the data were omitted to allow convergence. We looked specifically at intervocalic environment, which is typical for lenition, and contrasted individual-level speech rate with phrase-level speech rate. Speaker's speech rate was calculated per speaker as in Study 1. Phrase-level speech rate was defined as average pointwise speech rate of all words in the phrase, except the pointwise speech rate of the word for which lenition was predicted (a confound between lenition and short duration). Log odds of deletion were predicted by a mixed effects logistic regression using ~10,500 segments, with log phrasal speech rate, log speaker average speech rate, the stress of the following vowel, age (binary in Buckeye), and gender as fixed effects, and segment, word, and speaker as random intercepts. Age and gender had no effect and were removed from the model (model comparison $p>.7$). Preceding a primary stressed vowel reduced the likelihood of lenition (β=-2.879, SE=0.48, z=-5.939, $p<10^{-8}$). Slow phrasal speech rate was indeed correlated with lower propensity to delete (β=-0.22, SE=0.053, z=-4.098, $p<10^{-4}$), as was slow individual-level speech rate (β=-0.31, SE=0.15, z=-2.034, $p<0.05$), consistent with current work on lenition.

Our findings demonstrate the importance of individual speech rate in sound change. Study 1 results confirmed that individual speech rate is a stable personal trait. Following the assumptions of most work in lenition, faster speech rate was found to be significantly correlated with increased deletion rate of intervocalic oral stops, a process not phonologically licensed in English. This effect went beyond phrasal speech rate, the immediate rate around the word which contained a deletion, and extended to overall individual speech rate, suggesting that it is not only local rate driving the effect. Gender and age were not found to be significant when controlling for local and individual speech rate, even though such demographic variables are usually involved in variable sound change patterns. Thus, at least for deletion, fast speakers may function as "early adopters" of sound change.

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The phonetics of pre-vocalic and non-prevocalic /r/ in bilingual Hindi-English speakers and the implications for sociolinguistics

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In this paper we analyze the phonetics of pre- and post-vocalic /r/ in a sample of Hindi-English bilinguals based in the cities of Delhi and Dehradun in North India. Speakers of Indian English have been characterized as either rhotic with a substrate-influenced tap post-vocalic /r/, or non-rhotic, depending on age, levels of English education, and acquisition of English in the home (Bansal 1990; Gargesh 2004; Sailaja 2009; Sahgal and Agnihotri 1988, Wiltshire and Harnsberger 2006). This overall picture of rhoticity is confirmed for the current sample; counteracting some more recent claims that rhoticity may be back in fashion for younger, elite speakers (Chand 2010).

Phonetic environment can be shown to have a much stronger effect on rhoticity than external factors in our data. In some environments, basilectal speakers are categorically non-rhotic and in others, acrolectal speakers are categorically rhotic. By introducing a greater range of variants of /r/ into the auditory analysis (Lawson et al 2014), we demonstrate that levels of rhoticity may previously have been overestimated: predominantly non-rhotic speakers can still have linking /r/, which has not always been distinguished from other post-vocalic /r/. The retention of linking /r/ is striking in a contact variety. Furthermore, our analysis shows that approximant /r/ in Indian English may be part of the substrate-generated system and should not be assumed to be an import. We argue that variant of /r/, phonetic environment and the interaction between the two must be taken into account for an accurate sociolinguistics of this variable.

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The long-term impact of glide and close vowel changes in Latin

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The goal of this poster is to explore, in an extended case study, the systemic repercussions of sound changes that -- independently of each other -- affect a small and coherent set within the phonological inventory of a language.

In the prehistory and early history of the Latin language several changes affected those sounds that are close to, or straddle, the boundary between vowels and consonants. The glides inherited from Proto-Indo-European ([j], [w]) were deleted, contracted with adjacent vowels, or resyllabified into the corresponding close vowels ([i] and [u], respectively) depending on context. In particular, intervocalic [j] was deleted often with concomitant vowel contraction, V[j] sequences developed into long vowels when not followed by another vowel, and C[j]V sequences developed into C[i]V; intervocalic [w] was often deleted, depending on the quality of the flanking vowels, and [w] was also deleted before round vowels; coda [w] was often contracted with preceding vowels; for these changes see Weiss 2009:80 and passim, Baldi 2002:270 ff., Leumann 1977:124 ff.). The close vowels [i] and [u] were also affected by several changes (depending on the environment they underwent conditioned mergers and redistribution with other vowels, mainly [e] and [o], respectively); but, even more importantly, their token number increased greatly in non-initial syllables via a series of changes referred to as Old Latin Weakening, whereby nearly all short vowels in non-initial open syllables and in most final syllables turned into close vowels (with several contextual factors affecting the outcome; for details see Sen 2015:80--88 or Weiss 2009:116 ff.).

While these sound changes were not simultaneous -- they certainly spanned several centuries --, and do not constitute a coherent series, their common feature is that they revolved around a pivotal section of the sonority scale, affecting the most sonorous consonants and affecting, or resulting in, the least sonorous vowels. These changes had interesting long-term repercussions for the Latin language. Their cumulative impact was a drastic change in the phonological properties of stems and affixes and in the distribution of affix variants as a function of the sound shape of stems. More precisely, in Classical Latin the phonological conditioning of affix variation came to depend crucially on the sonority of the stem-final segments (see Cser 2015). Partly as a result of the sound changes mentioned above (and partly due to morphological changes not to be discussed here) the most important cut-off points in the phonological environments -- arranged into the sonority scale -- are the following: C || u i || V for nouns and adjectives, and C u || i || V for verbs. A further result of the changes affecting glides is that no verb, noun or adjective stem ends in [j], and only heteroclitic noun stems (as well as several verb stems) end in [w]. Also, [i]-final stems show pervasive heteroclisy for verbs, nouns and adjectives.

These phonologically based asymmetries are directly related to sonority and represent the long-term impact of sound changes that affected glides and close vowels. Their understanding leads to new insights regarding sonority-related phenomena in a wider context.

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Social evaluation addresses actuation in sound change

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Long-considered the quintessential problem in studies of language variation and change, the ACTUATION PROBLEM [1] has intrigued linguists for decades. Contrary to seminal variationist works that have tackled this problem by turning to regional identity [2], intracommunity dynamics [3], or social networks [4], we argue that the social correlates of a variable in a community, or the EVALUATION PROBLEM, can account for a change's absence. This is illustrated with a variable that has taken on social significance due to its perceived correlation with certain socioeconomic, regional, and racial groups: American English (AE) /ɹ/.

Postvocalic rhotic deletion is a common phenomenon in English diachrony; a majority of world Englishes are r-less [5, 6] and some traditionally rhotic dialects, such as certain varieties of Scottish English, are undergoing rhotic reduction [7]. /ɹ/ reduction took on prestige status in AE in the late 19th century: Hollywood actors dropped their /ɹ/ and students at prestigious finishing schools received elocution instruction [8]. An s-curve of /ɹ/ loss began in AE, but terminated mid-course. This raises the diachronic question: why not here, why not now? The answer may reside in the social evaluation surrounding /ɹ/ reduction in American English. Southern American English and African-American Vernacular English, both highly stigmatized outside of their speech communities [10, 11], are r-less dialects [12]. We hypothesize that speakers of standard AE, conscious of the social attributes of r-lessness, will exhibit REVERSE FREQUENCY EFFECTS. Usage-based models predict a negative correlation of word duration and frequency: higher frequency items undergo more reduction [13, but see 14]. However, if speakers are (sub)consciously resisting /ɹ/ reduction for socio-evaluative reasons, they are more likely to do so in high frequency words – those words that they have opportunity to use.

We test this utilizing the Buckeye Corpus of conversational AE [15]. It comprises interview data from an age- and gender-stratified speaker sample born and raised in central Ohio. Interviews have been phonetically aligned and hand-corrected. Non-word initial /ɹ/ and /ɚ/ tokens from 39 speakers (N=20 female, N=20 < 40 years) were automatically extracted from the corpus for a total of N=35179 tokens. Log transformed word frequency was calculated via the SUBTLEX index [16]. The ESPS program "formant" extracted formant measurements [17]. To ensure uniformity for the F3 measurement, only F3 tokens within two SDs of the mean were included (N=33470). Linear mixed effects models predicting both duration and F3 were fit in the `lme4` and `lmerTest` programs in R [18] with phone (/ɹ, ɚ/), gender, age, word frequency, and their interactions as fixed effects and speaker as a random effect.

Model 1 found that word frequency was a significant predictor of phone duration (β= 0.016, p=0.002). This is a reverse frequency effect: higher frequency words had longer rhotic phone durations. These results were replicated in a dataset including only postvocalic /ɹ/ (β= 0.039, p<.001). The relationship between word frequency and phone duration suggests that speakers monitor rhotic realization. Model 2 found that frequency was not a significant predictor of F3 (β= .0194, p= 0.85).

These results indicate that speakers avoid using socially-stigmatized variants in words of higher frequency – social biases, known to propagate sound change, are instead inhibiting a leniting phenomenon. The presence of this relationship even in C__ position, where /ɹ/ reduction does not canonically occur, suggests that speakers may be hypercorrecting. The reverse frequency effect shown here stands in stark contrast to tendencies in lexical diffusion for high frequency words to lenite before low. We use these findings to argue that by examining sound changes through a sociolinguistic evaluative lens, we can potentially resolve quandaries in diachronic sound patterning and lexical diffusion and respond to the actuation problem.

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Generational and individual trends: Vocalic compression in the California Vowel Shift

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This paper examines the California Vowel Shift (CVS) as it has unfolded across inland California, coupling quantitative analysis of macro-level changes with qualitative analysis of individual vowel spaces. To assess the progression of the shift at a broad level, we conduct a sociologically-motivated generation-based analysis of the CVS in apparent time. Incremental differences across four generations of speakers reveal that many of the individual components of the CVS shifted concurrently, and some within the span of just one generation. The nature and velocity of these changes, along with more holistic measures of vowel space dispersion, support a general characterization of the CVS as a horizontal *compression* of the entire vowel space. We then use these generation-based patterns to scaffold a qualitative analysis of individual vowel space configurations *within* these generations. Analysis of individual patterns reveal that a great deal of variation exists within generation groups, with individuals drawing upon various components of the CVS to differing degrees. Thus, though we see a general shift toward horizontal compression of the vowel space, individuals appear to achieve this compression in diverse ways.

Tokens of nine vowel classes (LOT, THOUGHT, KIT, DRESS, TRAP, GOOSE, GOAT, FLEECE and FACE) were extracted from interviews with 72 speakers from communities spanning California's Central Valley (N tokens = 16,481). To analyze sound change incrementally, each speaker was classified by generation according to birth year (Pew Research Center 2015): *Silent Generation, Baby Boomers, Generation X,* and *Millennials*. Using mixed effects models fit on Lobanov-normalized F1 and F2 midpoint measurements for each vowel token, results demonstrate an apparent time change in the expected direction of the CVS, with a majority of the changes occurring *contemporaneously* between the Silent and Boomer generations, in what appears to be an overall front-back compression of the vowel space. The changes that unfold in the two subsequent generations are continuations of this compression.

Two measures examined vowel space compression further. First, we use Pillai score as an indicator of front-back distance between high vowels FLEECE and GOOSE and between mid vowels DRESS and GOAT. For both pairs, Pillai score decreases across generational time, indicating horizontal convergence and thus compression. Second, as a holistic measure of dispersion, Euclidean area of each speaker's vowel space (Bradlow, Toretta, and Pisoni 1996) was calculated using five peripheral vowel classes. Euclidean areas of Millennial and Gen-X vowel spaces are significantly smaller than those of Silent Generation and Boomer speakers, again indicating apparent time compression of the vowel space (Fig 1).

The generational analysis provided a basis for qualitatively examining individuals' vowel spaces *within* generational cohorts. Individual analysis reveals much intra-cohort variation. For example, while Silent Generation speakers showed a consistent relation between TRAP, LOT, and GOAT in the vowel space, Boomer, Gen-X and Millennial speakers fell into one of three different sub-configurations of these vowels, not neatly predicted by generation group (Fig. 2). As another example, while nearly all Millennials and Gen-Xers showed some component of the shift toward compression, only some exhibited centralization of *both* the back and front vowels; others centralized either back or front vowels. Thus, broad generational trends are not cleanly borne out in individual speakers, though subsets of configurations suggest patterns that may reflect social factors not captured by broad demographic categories. We point to these individual differences as a starting point for examining social meaning-based uses of components of a sound change.

Figure 1: Overlapping outlines of peripheral vowel area of one Silent Generation male (red) and one Generation X female speaker (blue)

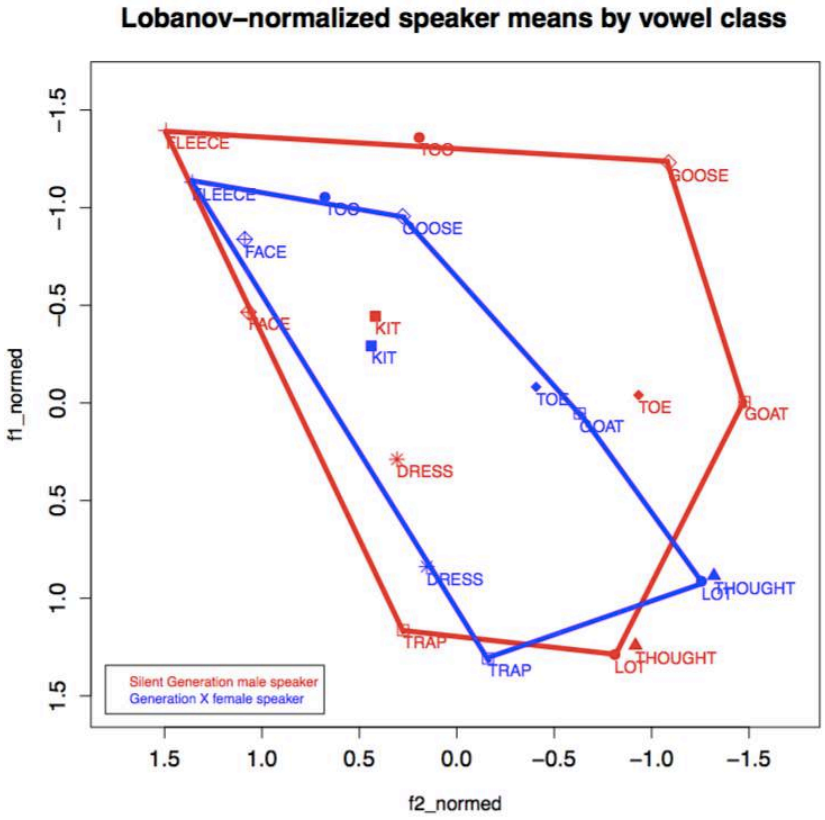
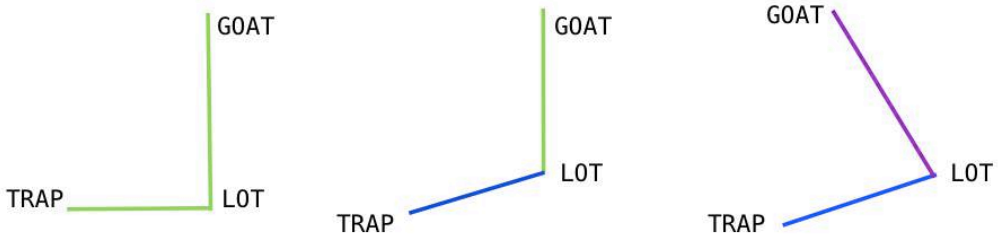


Figure 2: Three vowel space configurations distributed throughout the Boomer, Gen-X, and Millennial generations



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Modelling social aspects of sound change with the Kamoso framework

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We present the *Kamoso* computational simulation framework for modelling interactions within a population and its application to the study of a phenomenon of post-nasal devoicing in Tswana. The model integrates social aspects like network structure and social status differences with individual aspects of language use in speech production and perception.

Computational simulations have long been discussed as a research method in the study of language change. Lamb [1961], for example, suggests "[...] placing models of specific languages in the machine and applying to them certain proposed general principles of linguistic change or certain kinds of external influences, to see what the resulting language would actually look like". Notable implementations of this idea include, a.o., the work by Boersma and Hamann [2008], Blevins and Wedel [2009] or Wedel [2006, 2009]. The Kamoso computational simulation framework is applied to study the effects of restrictive, Apartheid-era, language policies, and more liberal post-Apartheid language policies, on the South African phylum. Nine indigenous languages were added to the list of official languages which previously included just English and Afrikaans. One of the languages influenced by this new social dynamics is Tswana, a Bantu language of the Sotho group. It has a phonetically marked post-nasal strengthening process, previously described by Zsiga et al. [2006] and Coetzee and Pretorius [2010]. This strengthening has been described as a phonetically unintuitive phenomenon requiring more articulatory effort than producing sequences of nasals and voiced stops [Westbury and Keating, 1986]. Pater [1999] points out that typological data, as well as phonetic evidence argue for a universal but violable *NC̥ constraint. Coetzee and Pretorius [2010], however, show that devoicing can be found in 80% of productions of post-nasal stops in their data collected from 12 speakers of Tswana. Moreover, 25% of those voiceless plosives are produced as ejectives, an even stronger type of voiceless plosive. It is argued that the devoicing tendency in Tswana post-nasal stops might result from historical changes [Hyman, 2001] during which a general stop-devoicing process happened at a stage where stops were observed only in post-nasal positions. Coetzee and Pretorius [2010] argue that the possible Tswana sound change (in progress) is phonetic in origin but once it is phonologized, it turns out to be independent from phonetics. With our computational multi-agent simulations we test predictions about the direction of this sound change apparently happening in Tswana. Speech recordings from Coetzee and Pretorius [2010] and the NCHLT_tsn corpus [Barnard et al., 2014] serve as a society sample. We put the two competing speech varieties (speakers with a voiced stop vs. speakers with strong post-nasal devoicing) through several simulation settings incorporating *Social Impact Theory* [Nettle, 1999] to model social dynamics, and *Exemplar Theory* to model speech production and perception and individual memory organisation. Individuals are modelled as agents, each with their own memory of previously encountered speech items (exemplars) serving as templates for future productions. The population is embedded within a *social network*. We test systematically different types of speaker–listener interactions and different types of network topologies (with or without *small world* properties [Milgram, 1967, Watts and Strogatz, 1998]), i.e. networks reflecting the parochial society structure of pre-1994 South Africa with largely closed language communities and other types reflecting the linguistic situation after 1994. Over several *epochs*, agents interact by producing speech items and transmitting them from speaker to listener. Factors like production noise, exemplar selection and production biases, perceptual warping as well as aging and death of individuals introduce variability which promotes change. Our results show the influence of social and linguistic factors. The model predicts differences in the direction of sound change dependent on network topology, social status of agents and their interactions.

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Sporadic nasalization of /h/: the loss of a rare contrast in Mixean Basque

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Eastern Basque dialects in France such as Zuberoan and the Mixean variety of Low Navarrese (Camino 2016) show a contrast between /h/ and a nasalized /h̃/ (compare *ehe* 'wash water' vs. *eh̃e* [ẽh̃ẽ] 'no', cf. Hualde 1993; Egurtzegi 2014), which continues Proto-Basque intervocalic *n (Michelena 1977; Igartua 2015). This cross-linguistically rare contrast between oral and nasalized aspirates has been lost in other Basque varieties: while western Basque dialects have lost aspiration altogether, the eastern Lapurdian and Low Navarrese have merged /h/ and /h̃/ in /h/ (1).

This contrast shows traces of recession in Zuberoan and Mixean as well, but it seems to be following different patterns: While in Zuberoan some etymologically nasalized /h̃/s have lost nasalization in the modern language (cf. Zuberoan *ahal* 'to be able to' to the derivative form *ah̃alke* 'embarrassment', both with a nasalized /h̃/ in Mixean Basque), recordings of speakers of Mixean Basque show a tendency towards nasalizing aspiration in contexts where no nasalization is historically found, including the examples in (2). This tendency has not been described for the Zuberoan dialect, but can be found in some speakers in the towns neighboring the region of Mixe.

In this paper, I analyze the loss of the contrast as an instance of equation of aspiration with nasalization: from some point, the speakers of Mixean Basque have begun to produce instances of the aspirate /h/ (<*h) with audible phonetic nasalization (cf. Ohala 1975), as occurred in other languages such as Thai (/haː/ [hãː] 'five', cf. Matisoff 1975), the Nepalese language Hayu or Scottish Gaelic (*àtha* [ãːhə] 'fore (gen. sg.)', Ó Maolalaigh 2003), in a process usually known as rhinoglottophilia (Matisoff 1975; Blevins 2004). In contrast to the other cases, given that Mixean Basque contrasted /h/ and /h̃/, the overgeneralization of phonetic nasalization in aspirates may yield the loss of the phonological opposition between /h/ and /h̃/ in this variety of the language.

To quantify the extent to which the /h/s (< *h) can be phonetically nasalized in Mixean Basque, I will measure and compare the acoustic nasalization in vowels in contact to /h/, /h̃/, /n/, /m/ and oral consonants. To this end, I will calculate the amplitude (in dB) of the lower nasal formant and F1 in different non-high vowels. Following the methods described in Zellou & Tamminga (2014) the degree of nasalization will be determined by subtracting the amplitude of the lowest nasal peak (P0) from the amplitude of the F1 harmonic peak (A1), thus A1-P0 dB.

In short, this paper presents a description of the loss in progress of a cross-linguistically rare phonological opposition between /h/ and /h̃/ in Mixean Basque. Acoustical measurements of the relative values of nasality are offered in order to show the tendency of gradually equating nasalization with aspiration in this variety of Basque.

(1) Modern reflexes of Proto-Basque *h and intervocalic *n

Reconstruction	**Western dialects**	**Lapurdian and Low Navarrese**	**Zuberoan and Mixean**	**Gloss**
*hasi	/aʂi/	/haʂi/	/haʂi/	‘to begin’
*aho	/ao/	/aho/	/aho/	‘mouth’
*anari	/aaɾi/, /aɾi/	/ahaɾi/	/ahai/	‘ram’
Lat. *anate*(*m*)	/aate/, /ate/	/ahate/	/ahate/	‘duck’

(2) Non-etymological /h/ nasalization in Mixean Basque

Zuberoan	**Mixean (sporadically)**	**Gloss**
behar	*behar*	‘must’
behi	*behi*	‘cow’
bihi	*bihi*	‘seed’
zahar	*zahar*	‘old’
hau	*hau*	‘this’
hotz	*hotz*	‘cold’
heuskaldun	*heuskaldun*	‘Basque’
hogei	*hogei*	‘twenty’

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Stages of tonogenesis in Punjabi

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This study attempts to quantify the phonetic realization of tone in Punjabi. Previous studies on Punjabi tone present conflicting, often impressionistic, claims as to its acoustic properties (Bhatia 1993, Malik 1995, Shackle 2003, Bowden 2012). In addition, prior studies only evaluated the Punjabi spoken in India, but not in Pakistan, where numerous Punjabi speaking communities are found. The present study finds that contemporary dialectal variation reveals the stages of tonogenesis in Punjabi.

Acoustic properties of minimally contrastive words were measured for multiple speakers across Indian and Punjabi dialects of Punjabi in order to provide a more quantified representation of the tonal contrast. This study found that for the Punjabi variety spoken in India, tone pairs correspond consistently to the presence of voiced aspirates in the orthography. For the Indian speakers recruited for this study, historically voiced aspirated stop initials have transphonologized into (a) high-falling tone on the initial syllable, or (b) low-rising tone on the preceding syllable, and high-falling tone on the following syllable when the triggering consonant is in non-initial position. However, for the Punjabi variety spoken in Pakistan, the reflex of historical voiced aspirates is inconsistent. Pakistani speakers use variable VOT cues, and subtle pitch differences to correspond to the historical distinction. The figures below demonstrate the varying FO reflexes between Punjabi speakers from the two different areas. The letters in the legend identify the VOT and laryngeal status of the word-initial consonant.

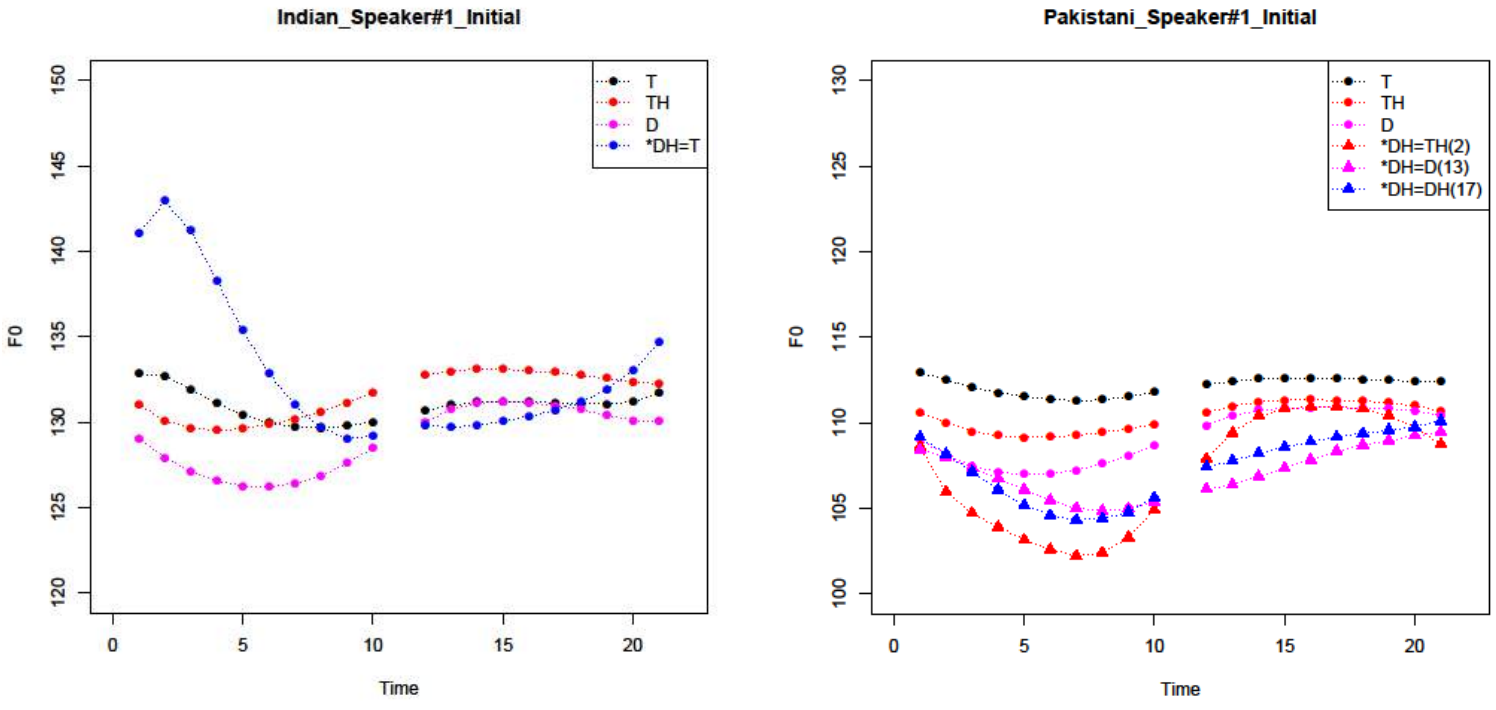

Figure 1 F0 pattern of Indian and Pakistani Punjabi speakers

For the Indian speakers, the historically voiced aspirate stop (*DH) has become devoiced (T) in initial position. Thus, the blue curve and the black curve mark existence of tonal minimal pairs. For the Pakistani speaker, the red triangles and circles show a potential pitch contrast on voiceless aspirates (TH), where those that reflect *DH have a falling F0. The pink circles and triangles show a more subtle pitch distinction for words beginning with *D -> D vs. *DH -> D. Moreover, the blue line shows that most historically murmured stops have maintained this articulation in modern Pakistani Punjabi.

As a language with a relatively young tone system, it appears that different dialects of Punjabi have undergone different degrees of tonogenesis as shown in Figure 2. Indian Punjabi speakers represent the final stage, in which F0 alone can distinguish voiceless unaspirated stops from historically voiced aspirates. However, Pakistani Punjabi speakers demonstrate an intermediate stage of tonogenesis, in which a variety of laryngeal settings (voicing, aspiration, pitch) inconsistently convey the same distinction.

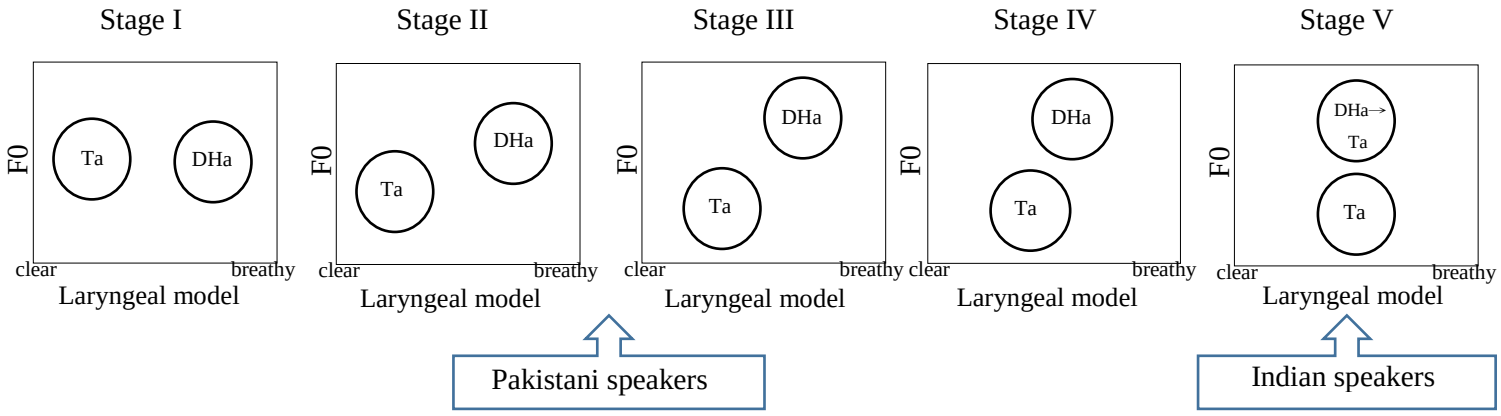

Figure 2 Five stages of tonogenesis in Punjabi (adopted from Kang, 2014)

A corpus-based investigation of sound change in Washington DC African American English

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Recent work on the vocalic systems of African American English (AAE) speakers have identified vowel configurations both aligning with Thomas's (2007) proposed African American Vowel System (AAVS; Fridland 2003; Thomas 2007) as well as showing some convergence to local European American varieties (e.g. Yaeger-Dror and Thomas 2009). Few studies, though, have examined how regional patterns have changed or developed over time within an African American community and the few that do (e.g. Wolfram and Thomas 2002) have focused on the changing relationships between European American and African American norms in their regional contexts. Comprehensive studies of sound change internal to an ethnic minority community have been exceedingly rare (Blake and Shousterman 2010; Fought 2013). The current analysis examines the vowel systems of Washington D.C. (DC) African American speakers over real and apparent time, paying particular attention to pan-regional features described in the AAVS (Thomas 2007). Additionally, we focus on the onset and glide of /aʊ/ (Thomas 2001), a local feature not discussed in the AAVS.

The data come from DC recordings in the (soon to be publically released) Corpus of Regional African American Language. To investigate change over time in DC AAE, the current acoustic analysis uses data from recordings made in 1968 and in 2015, with 90 speakers, whose dates of birth range from 1890 to 2002, roughly balanced for age, sex and social class. A combination of hand-measurements and automated corpus sociophonetic techniques were applied (MFA and FAVE-extract) (McAuliffe et al. 2016; Rosenfelder et al. 2011) to extract formant data.

In our presentation, we first present a qualitative analysis of the speakers' vowel systems to identify trends over time. We then present quantitative analyses focusing on specific vowel classes relevant to the AAVS. As a part of the presentation, we also discuss some of the technical aspects of using automatic phoneme alignment and extraction on a corpus of vernacular AAE. Finally, we consider how the automated results compare to vowels that were hand-measured for a subset of the speakers.

Results indicate three general patterns over time: stability, monotonic change, and curvilinear change. While some features typical of the AAVS, like pre-nasal /ɪ/~/ɛ/ merger and non-prevoiceless /ai/ glide weakening, are stable over time, other features show monotonic change. The longstanding regional voicing pattern of /aʊ/ (Thomas 2001), most evident in the oldest generation, is in recession. Other features exhibit a curvilinear pattern. For example, /e/~/ɛ/ nuclei overlap, a pattern expected in the AAVS, is most evident in the middle generation, but lacking for the oldest and youngest speakers. Additionally, /u/ fronting, not associated with the AAVS, is evident only in the middle generation. Taken together, these results suggest a complex pattern of change and stability. The AAE speaking community in DC has undergone changes that are not simply movements towards or away from an external norm like a monolithic AAVS, but rather represent the ongoing development of a regionally-based ethnolect.

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On the retention of an old feature in the Tamang dialect of Taglung

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The languages of the Tamang group (Tibeto-Burman, Nepal) are presently in the process of developing tones from an earlier opposition of voicing on word-initial consonants ("tone split" in an old two-tone system: voiceless onsets > 2 high tones; voiced onsets > 2 low tones). In this group of languages, we observe a large amount of variation between dialects, between speakers, and within speakers concerning the realization of the features which define each tone. We interpret these variations as different degrees of retention of earlier features (Mazaudon, 2012). A previous phonetic study of the Tamang dialect of Risiangku (Mazaudon & Michaud, 2008) demonstrated the use of F0 and phonation, and to a lesser degree of initial stop voicing, as cues to the four tones of the system. Initial stop voicing is an occasional secondary cue to low tone, but in no case can it be distinctive. The retention of breathiness and stop initial voicing with low pitch tones may be explained by mutual enhancement (Silverman, 1997).

In the Tamang dialect of Taglung, one of the two low tones has evolved into a high falling tone. However, we still observe occasional retention of word-initial voicing (word-medial voicing is not contrastive), not only on the present-day low tone, but also on the historical low tone which is no longer low. The conditioning of this retention is the object of the present study.

In order to examine the distribution of initial stop/affricate voicing, we analyzed electroglottographic (EGG) data of 351 word-tokens in total (including 250 different words) from four speakers (2 males) of the Tamang dialect of Taglung, recorded in Taglung village, Nepal. The analyzed words are monosyllabic nouns and verbs, the latter necessarily followed by a suffix, each produced three times in isolation and three times in a carrier sentence. The target syllable carries one of the tones T1–T4: T1 and T2 are high tones evolved from voiceless onsets; T3 (low) and T4 (high falling) are tones evolved from voiced onsets; F0 contours of the modern tones of one speaker are shown in Figure 1. Note that tone is carried by the entire word. Our preliminary results show different factors which determine the presence of initial voicing.

First, and most important, the tonal context. Onset voicing occurs only on T3 and T4 syllables. Hence, the recently created high/low opposition in Tamangish languages is probably still tightly related to initial voicing (Svantesson, 2014). We assume that this link is memorized at the cognitive level. One speaker shows exceptions, which we will explain below.

Second, lexical item. The only stable and systematic initial voicing across all speakers and contexts concerns the following words, all on T4 and all with labial initials: *[4]bli* ('four'), *[4]bre:* ('eight'), *[4]bra:* ('cliff'), *[4]baŋ* ('strength') and its derived form *[4]baŋba* ('be strong'). The word *[4]bra:* ('cliff') forms a minimal pair with *[4]pra:* ('flour'), probably replacing an old contrast unrelated to voicing. The remaining three words are all frequent, which leads us to suspect an effect of lexical frequency. This is in line with Bybee (2001)'s idea that high-frequency items are most resistant to analogical change.

Third, phonetic environment. Onsets of T3 and T4 syllables are more frequently voiced in environments that phonetically favor consonantal voicing: with labial onsets, high vowels (or glides) (Ohala & Riordan, 1979) and in carrier sentences (that is, preceded by another word). Individual variation is greatest at this level: labial onsets clearly facilitated voicing only for speaker M1, and high vowels (or glides) only for speakers F1 and F2 (see Table 1). While all speakers produced occasional voicing in intervocalic and unstressed context (sentence internally) on T3 and T4 words, speaker F2 extended the voicing to T1 and T2 words (where voicing is not etymological), demonstrating a new function of voicing in her usage.

In sum, in transphonologization, the earlier features are retained especially on phonetically favored units, but not uniquely. They also seem to be retained preferentially on high-frequency items. If coarticulation-based sound change begins with high-frequency items (e.g., lenition: Pierrehumbert, 2001; Hay & Foulkes, 2016), sound change involving loss of an earlier feature seems to begin with low-frequency items, as shown by our limited data. In this it is comparable to analogical regularization, as in morphology (e.g., French verb conjugation). This hypothesis, which needs to be confirmed by a larger-scale investigation, is in line with the view that the realization of redundant features that are left over from a historical change is willful and intended, contrary to the realization of redundant features that are coarticulation-based, which is automatic and predictable.

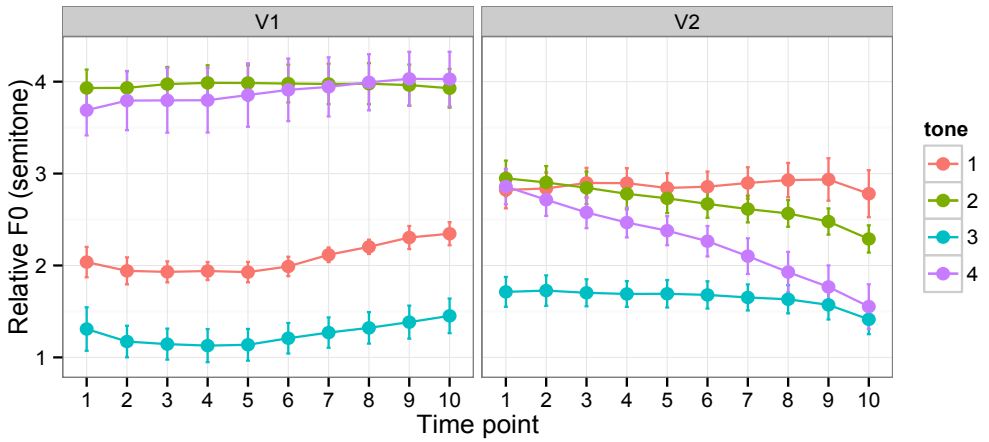

Figure 1. Illustration of F0 contours (relative to frames) of the four tones of /k/-onset verbs (V1: first vowel; V2: second vowel), from speaker M1 (36-year-old male).

Table 1. Number and proportion of T3 and T4 words with quasi-systematic word-initial voicing in carrier sentences (for M1 and F1: sentence-internally; for F2: sentence-initially), according to context, from three speakers (M1: 36-year-old male; F1: female in her 40s; F2: female in her 70s). Words with constantly voiced onsets (⁴bli, ⁴breː, ⁴braː, ⁴baŋ, and ⁴baŋba), and words with cluster onsets (few items) are excluded.

	M1	**F1**	**F2**
labial (p-b)	7/11 (64%)	1/4 (25%)	2/14 (14%)
dental (t-d)	2/9 (22%)	0/4 (0%)	5/19 (26%)
denti-alveolar (ts-dz)	0/11 (0%)	3/7 (27%)	5/7 (71%)
velar (k-g)	0/12 (0%)	0/6 (0%)	0/10 (0%)
high vowel/glide (i, u, j)	3/16 (19%)	3/7 (43%)	10/19 (53%)
non-high vowel	6/27 (22%)	1/14 (7%)	3/31 (10%)

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Dialect change in a multicultural metropolis: The role of ethnicity in the London diphthong system

Labov's (1994) principles of vowel shifting are based on internal linguistic constraints that are widespread and occur across many different languages. However, as Labov (1994, p. 140) notes, these principles are not without exception, largely due to the pressures of social factors. One such exception is evidenced in recent work in South East England, whereby instances of levelling and diffusion (Kerswill and Williams, 2000) as well as innovation and supralocalisation (Kerswill et al., 2008) have seen a developing sound change manifest as a reversal of the traditional diphthong shift. For example, Kerswill et al. (2008) found that traditional East London diphthongs used by older speakers were much less common among younger speakers, particularly those from the inner city. Their results indicate that the diphthong shifted characteristics of traditional cockney are reversing; inner city youth are now more likely to use unshifted diphthongs, at times with monophthongal qualities. However, it is still unclear as to what precisely the sources, mechanisms, or motivations of this ongoing sound change may be (Kerswill et al., 2008, p. 487). This critique is indicative of a larger issue in variationist sociolinguistics, that questions the role of identity, social meaning, and the individual in sound change (e.g. Coupland, 2008; Holmes and Kerswill, 2008).

In order to contribute to the wider theoretical discussion as well as further our understanding of sound change in London, I aim to answer the following questions:

- Are diphthongs continuing along the same trajectory of change discovered by Kerswill et al. (2008)?
- What role do race and ethnicity play in language variation London? Does this shed light on the sources, mechanisms, and/or motivations of sound change?

To address these questions, I present data from a twelve-month ethnography of 14-15 year old adolescents in an East London secondary school. The data consist of 30 interviews and 7 group recordings with 28 students (19 females, 9 males). The trajectories of diphthongs FACE, GOAT, PRICE, and MOUTH were analysed by measuring onset and offset using an automated Praat script . Results show that whilst some speakers align with the findings of Kerswill et al (2008), this is not the case for all participants in this study. Vowel realisation does appear to relate to diversity of friendship group (Cheshire et al., 2011) but shows more ethnic stratification than so far shown for

working class London English. For example, White British female participants show high levels of conformity to traditional diphthong shift settings, something that previous findings (Kerswill et al., 2008) indicate to be near-absent in an inner city borough. The emerging ethnic stratification sheds further light on the issues of sources, mechanisms, and motivations of sound change in London diphthongs.

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Modelling similarity-driven phonologization

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In Turkish, a change in progress targeting the front mid vowels causes realisations of /e/ and /ø/ to be conditioned by the following coda; /e/ and /ø/ appear to follow the same apparent-time trajectories, but with /e/ leading. Apparent-time analysis of production data from an ongoing study of native Turkish speakers suggests that the **initial** state is represented by little variation in /e/-realisations across contexts, save slight lowering in final open syllables – that is, $F1_{open} > F1_{obstruent} \approx F1_{sonorant}$. For speakers who have **progressed furthest** in the change, pre-sonorant /e/ is lowered to [æ], categorically separated from the other contexts, and pre-obstruent /e/ is raised: $F1_{sonorant} \gg F1_{open} > F1_{obstruent}$. Speakers positioned at **intermediate** stages in the change show a small separation between the pre-*rhotic* context and others, a categorical separation between sonorant contexts as a whole and non-sonorant contexts, and no meaningful effect in the obstruents: $F1_{sonorant} \gg F1_{open} \approx F1_{obstruent}$.. Vowel lowering in closed syllables or before a rhotic coda is widely attested (French, Catalan /e/ (Bradley 2010), Swedish /ɛ/ and /ø/ (Joseph 2001), Faroese /e/ (Árnason 1999), various Swiss German varieties in /o/ (Keel 1982, Janda & Joseph 2001), inter alia); the Turkish case is distinct from these in involving a generalisation to all [+sonorant], and in the appearance of an unequal (in magnitude) but opposed pre-obstruent effect.

To model the progress of this change computationally, we set up a speaker-listener loop, assuming a constant low-level phonetic bias for pre-rhotic /e/ – that is, we assume that the change is initially triggered by phonetically-driven lowering in some subset of input pre-rhotic /e/ tokens. In this model, the listener first samples an input distribution of /e/ in the different environments – where the coda is either open, an obstruent, rhotic, or a non-rhotic sonorant – and arrives at prototypical representations of /e/ in each environment. The phonetic bias for pre-rhotic /e/, however, serves to lower a proportion of /e/ tokens at each iteration of the loop, giving rise to a bimodal distribution. The generalization of the lowering to the entire class of sonorant coda environments is accounted for by a tendency in the listener to treat similar environments similarly, where 'similar' is to be understood in terms of a feature similarity metric. Within this, environments sufficiently dissimilar to each other may show 'antisimilarity', and be assigned negative scores with respect to each other. The antisimilarity-sensitive listener tends to oppose lowering in environments very dissimilar to those triggering the change, giving rise to a system in which opposing forces interact and cause the system to reach a stable state over time. Figure 2 shows the behaviour of our model across 100 iterations, starting from an initial condition which represents the distribution of /e/ at the earliest point of time in our data. From here, the phonetic and feature similarity biases interact, causing the sonorants to be attracted by the exceptional subset of rhotics. In the pre-obstruent environment, /e/ undergoes raising rather than lowering, because of the high feature dissimilarity of obstruents and sonorants. In open syllables /e/ undergoes some lowering, as open syllables as a neutral environment tend to follow the overall F1 mean of /e/. These results show that the behaviour of our model is in broad qualitative agreement with the pattern observed in our dataset. Figure 3 gives the F1 mean of /e/ in the different environments across a much larger number of iterations, illustrating how the model tends to a stable state over repeated interactions in the speaker-listener loop.

To our knowledge, this model represents a novel attempt to model the generalization of a rule from an initial phonetic motivation to a phonological natural class, using the notion of a feature similarity metric: we introduce in particular the proposition that the application of a rule in novel environments may be proportional to said environments' distance from the original trigger. In the case of the Turkish front mid vowels, the model also explains two additional but related phenomena: the radical raising of the vowel when followed by an obstruent and the much less radical lowering of open vowels, from the assumption that antisimilar (to the canonical targets of the process) environments will oppose application of the rule and that neutral environments 'drift' by essentially tracking the overall mean behaviour of the vowel. The robustness of the model under parameter variation will be discussed, as will the subsequent extension of the rule to /ø/.

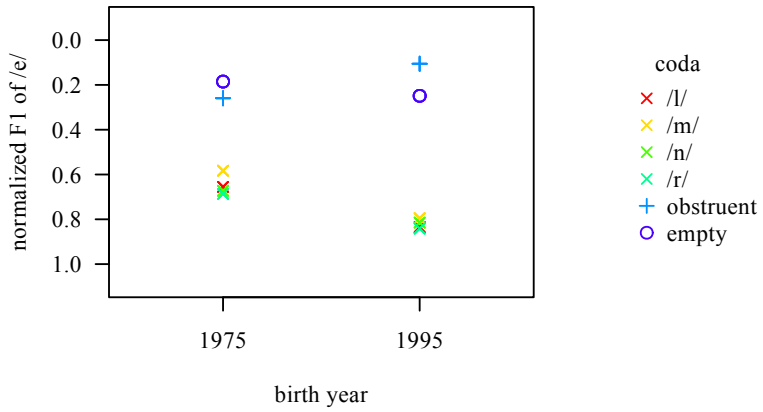

Figure 1: Mean normalized F1 for /e/ across speakers separated by 20 years' apparent time.

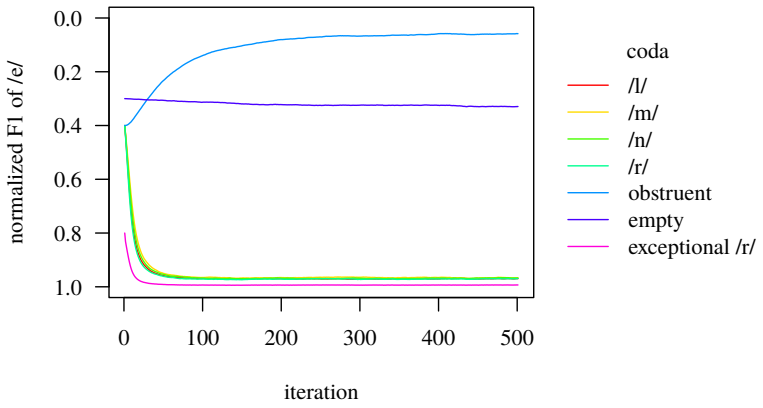

Figure 2: Mean F1 of /e/ over 500 iterations of our model.

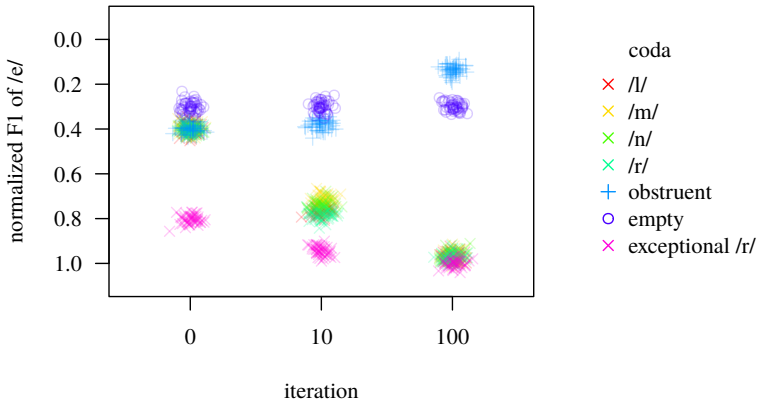

Figure 3: Distribution of /e/ shown at 0, 10, and 100 iterations of our model.

The seemingly hybrid word-stress systems of five Germanic languages

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The prosody of Dutch, English, German, Icelandic and Swedish monomorphemic words is characterized by the fact that main stress may be assigned according to three conflicting principles:

(i) The Germanic word stress rule which assigns stress to the initial syllable of the stem.
(ii) The Latinate word stress rule which assigns main stress to the penultimate syllable if heavy (i.e. a long vowel, diphthong or short vowel plus consonant) and otherwise to the antepenultimate syllable.
(iii) The Romance stress rule which assigns main stress to the final syllable of a word.

According to e.g. Cutler (2005), English has more monosyllabic words than Dutch and German. Together with Icelandic and Swedish, Dutch and German have relatively many bisyllabic words that end in an unstressed syllable with a reduced vowel quality. Jusczyk and colleagues, among others, have shown that in their first year of life, infants who learn a Germanic language are sensitive to a trochaic pattern. However, this pattern is not always obvious in polysyllabic words. With respect to polysyllabic words, we note first of all that in Icelandic, word stress is always initial. We will furthermore show that in tri- and quadrisyllabic words, stress is initial in the majority of the cases in English and Swedish, whereas main stress is initial in only 18% to 20% of the cases in Dutch and German. In the latter two languages, main stress is sometimes final, but most often prefinal (see also e.g. Féry 1998 for German). On the surface it may thus seem that in Dutch, English, German and Swedish, the Germanic word stress system is in competition with other stress assignment processes.

In addition, the morphological structure of a word may be of influence to main stress assignment. Some suffixes do not attract stress (e.g. German *–los*, *-igkeit* in *Schlaflosigkeit* 'sleeplessness' with word-initial stress), some behave according to the regular stress rules for monomorphemic words (e.g. German *-in* in *Prinzessin* 'princess' with prefinal stress), some require stress on a preceding syllable (English *-ity* in *electricity*) and some suffixes require stress on the last syllable of the suffix (Dutch *-in* in *hertogin* 'duchess').

In this paper we will argue that even though Dutch, English, German, Icelandic and Swedish have the same origin, their present metrical systems are minimally different, but none of them is 'replaced' by the Latinate system to assign main stress. The minimal differences, however, have a huge impact on the vocabulary of the respective languages and for this reason the differences may seem more drastic than they actually are. We will explore the emergence and effect of individual language contact situations by examining the history of 100 French and Latin loan words and loan suffixes that Dutch, English, German and Swedish share and that Icelandic lacks. It will be shown that language contact led to slight modifications in the respective metrical systems at different periods in time.

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Reconsidering preventive dissimilation: similarity and co-occurrence in sound change

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A well-known characteristic of long-distance consonant assimilation is its sensitivity to relative similarity (Rose and Walker 2004; Hansson 2010): consonants are more likely to be subject to assimilation if they already agree in some other property (e.g. place, manner, or phonation). For example, in Kalasha (Indo-Aryan; Arsenault 2012) a historical process of retroflex assimilation appears to have affected stop…stop, affricate…affricate and fricative…fricative sequences (e.g. /ʈ̪ãɖʐa/ 'pinewood torch' < */ʧanɖʐa/ < /ʧandra/) but not mixed-manner sequences like affricate…fricative (/ʧuʂ-/ 'to suck' < /ʧu:ʂ-/). Cases like these suggest that sensitivity to trigger-target similarity is present from the outset and must thus play a role (facilitatory or inhibitory) in the sound changes by which such non-adjacent assimilations arise. This lends support to the hypothesis (Garrett and Johnson 2013, cf. Hansson 2010) that the mechanism behind such non-adjacent assimilations is phonologization of (speaker-based) motor-planning errors, rather than of (listener-based) misperception/misparsing of coarticulatory effects (cf. Ohala 1994; Blevins 2004).

However, this ignores the fact that synchronic patterns of consonant harmony have diverse diachronic origins, which sometimes do not involve any corresponding historical process of assimilatory sound change (cf. Hansson 2007). I discuss a number of cases where it appears that a preference for consonant agreement has affected the application of some other, independent and unrelated sound change. In situations where that sound change would have led to the appearance of a highly similar but non-agreeing C…C sequence, the change may be blocked. Interestingly, there is often little or no evidence that the avoidance of disagreeing sequences had any clear motivation within the lexicon or phonology of the language at the time.

For example, the emergence of retroflex harmony in many Dravidian languages has been partly caused by the conspicuous failure of retroflex stops to arise in initial position (where they were absent in Proto-Dravidian) in precisely those cases where a dental stop followed (Arsenault 2012). In other words, a dispreference for Ṭ…T sequences (but not for other Ṭ…C sequences, which were equally unattested) seems to have inhibited relevant processes of sound change (e.g. */tr, dr/ > */ʈ, ɖ/) as well as borrowing (of words with Ṭ…T) from Indo-Aryan languages.

An even more striking example is that of Yabem (Oceanic; Dempwolff 1939; Hansson 2010), a rare instance of consonant harmony in constriction degree. Here /s/ harmonizes with an alveolar stop in the next syllable; for example, 3Pl /se-/ surfaces as [te-] or [de-] before roots with initial /t, d/. This apparent 'assimilation' of [s…t/d] sequences to [t/d…t/d] appears to originate entirely (or almost entirely) in the failure of an otherwise regular sound change of *t > s / ___$V_{[front]}$ to apply in precisely those cases where another *t followed (Bradshaw 1979).

Grammont (1895) coined the term *dissimilation préventive* for the blocking of sound change when it would otherwise produce a co-occurrence of identical consonants. However, in the cases I have found there is no avoidance of identity or repetition, but rather of non-agreement (along some phonetic dimension) in the presence of high similarity (along other dimensions). Analogous effects have sometimes been observed in studies of sound change in progress. For example, in her study of assibilation and deassibilation in Argentinian Spanish, Colantoni (2001) found that in words with rhotic…rhotic or palatal…palatal sequences, there is a strong tendency to either assibilate both consonants or neither, whereas in words containing both a rhotic and a palatal, the equally strong tendency is for one and only one to be assibilated. I conclude by discussing what such findings may

suggest about where the 'agreement preference' enters into the sound change process. Rather than shaping the initiation stage (as presumed by the motor-planning-error hypothesis), it may instead (or in addition) shape later stages when a pattern of variation is becoming stabilized at the individual and community level.

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Hormonal Organizing Effects and Sound Change from Below

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Although effects of speaker sex on progress of sound changes is widely reported, analyses of language and sex/gender have thus far been restricted to the study of social factors, often in combination with some notion of identity. Furthermore, studies of the effect of gender on sound change have often restricted this notion of identity to a binary distinction of men and women, whereas many now view gender in a more continuous way. We present a model in which social factors interact with biological factors that are known to influence gender identity, and these together result in observed patterns of variation during sound change in progress. We also show empirically that a continuous biological factor, pre-natal exposure to androgens, has a continuous effect on a change in progress, the rise of pre-aspiration before voiceless obstruents in Tyneside English.

The pattern of women leading sound change from below has been replicated in many studies across the English speaking world and cross-linguistically, with little consensus as to an explanation. Labov (2001) suggests that the initial generation of men will retreat from any new women-led change, causing a lag which persists in later generations, but the reasons for the retreat are unclear. Eckert (2011), and much related work, suggests that women actually drive change for socio-psychological reasons, but it's left unclear exactly why it's prestigious to drive change that speakers are not socially aware of. Clearly changes must proceed through social learning, as linguistic variation is all learned through social contact, but it is unclear that social motivations could create the often subtle quantitative patterns of sound change in progress.

Interestingly, a growing field of behavioural neuroendocrinology has shown that the perinatal hormonal milieu of developing organisms has a strong effect on various adult behaviours in both humans and non-humans (see e.g. Balthazart 2011; Balthazart et al. 2009; Hines 2006). Pre-natal exposure to testosterone in humans has been shown to influence later gender-identity (Berenbaum and Bailey 2003; Cohen-Bendahan et al. 2005; Hines et al. 2004, 2015), gendered-behaviour (Auyeung et al. 2009; Pasterski et al. 2005), and social learning (Hines et al. 2016; Lutchmaya et al. 2002). In a potentially related result, Yu (2010) showed that individual and sex-related cognitive style differences have a significant effect on the perception of phonetic variables. The organising effects of sex hormones on the brain are a potential underlying mechanism for differentiated social learning by individual speakers. While this could broadly result in the differentiated use of linguistic variants by men and women during change in progress, we suggest that the men vs. women effect is epiphenomenal, and a continuous bio-social effect is primary. We test the hypothesis that, within a single sex cohort, a continuous biological proxy for early life androgen exposure predicts the advancement of an ongoing sound change.

The current paper presents data from free-production interviews with 22 women from the Tyneside area (AFAB and female-identifying), with an average of 100 tokens per speaker. We measured durations of pre-aspiration preceding voiceless obstruents, a variant known to be on the rise in contemporary Northeastern Englishes (Watt and Allen 2003). We use the second-digit-to-fourth-digit ("2D:4D") finger length ratio as the biological predictor; this is a well-known correlate of *in utero* testosterone exposure, which has been validated by amniotic fluid measure in humans (Lutchmaya et al. 2002) and experiment in rats (Talarovičová et al. 2009). Controlling for age and other social factors, a linear regression showed a significant relationship between 2D:4D and the duration of pre-aspiration for our sample ($p < 0.02$).

Given the fact that all speakers in the sample currently identify as women and were socialized as women in early life, we suggest that the social category "women" is not

explanatory for the effect of gender on this sound change. Rather, we suggest that the social learning of this linguistic variant was influenced by different early life effects of testosterone on the brains of individual speakers.

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Acoustic evidence from spontaneous speech for sound change in Korean sibilants

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Introduction. While it is generally accepted that the three affricates of Seoul Korean, /tɕ*, tɕ, tɕʰ/ have the same place of articulation, often described as alveolopalatal [1] or alveolar [2, 3], a recent acoustic study [4] reported that Seoul females in their 20s tended to produce affricates in a more anterior location than their male counterparts. As this result may indicate a sound change, the current study expanded the age range of investigation to explore possible interactions between age and gender in the place of articulation of Korean affricates and fricatives in spontaneous speech.

Method. We measured the spectral peak frequency (SPF) of the frication portion of the affricate (n = 9934) and fricative (n = 9288) productions of 30 Seoul talkers, comprised of 10 talkers (5 male, 5 female) from each of three age groups (teens, 20s, and 40s), taken from the Seoul Corpus [5]. Because the Korean fricatives /s, s*/ are alveolar before /a/ and alveolopalatal before /i/, we used the SPF of the fricatives as a benchmark by which to determine the degree of fronting in the affricates. That is, if the SPF is higher in the affricates than in the fricatives, it would suggest that the affricates were articulated at a more anterior location.

Results. Mixed effects linear regression models were built to test whether the manner (affricate vs. fricative) and gender interacted in explaining the variation of the SPF, which was assessed by comparing the fits of regression models with and without the interaction term [6]. Models were built separately for each age group.

Besides overall higher SPF in females' productions than in males' (presumably due to physiological differences in vocal tract shape), there were gender-related differences in the SPF of affricates and fricatives: The SPF differences between affricates and fricatives before /a/ were smaller in females' productions than in males. Moreover, this gender-related pattern of SPF was most clear in the teens' word-medial productions and least clear in those of speakers in their 40s. The output of the regression models confirmed these observations, revealing that the interaction effects of manner and gender were significant only in the teens' productions of word-medial tense and lax tokens ([lax] $\chi 2(1) = 5.83$, $p < .05$; [tense] $\chi 2(1) = 5.65$, $p < .05$). In the other two age groups, the interactions were not statistically significant ($p > .5$).

Although we interpreted the results of the mixed effects models to tell us something about affricate fronting, a closer look at the overall group trends in SPF revealed that the female and male speakers exhibited very different patterns across age and manner. Specifically, although the mean SPF of the affricates in the females increased from older to younger speakers as expected, it remained constant among the males (see Fig. 1). On the other hand, the mean SPF of the *fricatives* in the males increased significantly from older to younger speakers, whereas it remained constant among the females. Therefore, although there are clear gender differences in terms of the place of articulation of fricatives and affricates, it cannot be solely attributed to a change in just the articulation of affricates.

Conclusion. The current results show that gender- and age-related differences in the production of Korean sibilants are not the result of a single segment changing in the production of only one gender. Rather, there appear to be two simultaneous changes underway, resulting in young males' and females' sibilants being different not only from each other, but also from same-gender speakers from an older generation. These results highlight the importance of couching acoustic approaches to sound change in

the context of the larger phonological system, beyond the particular segment(s) of interest.

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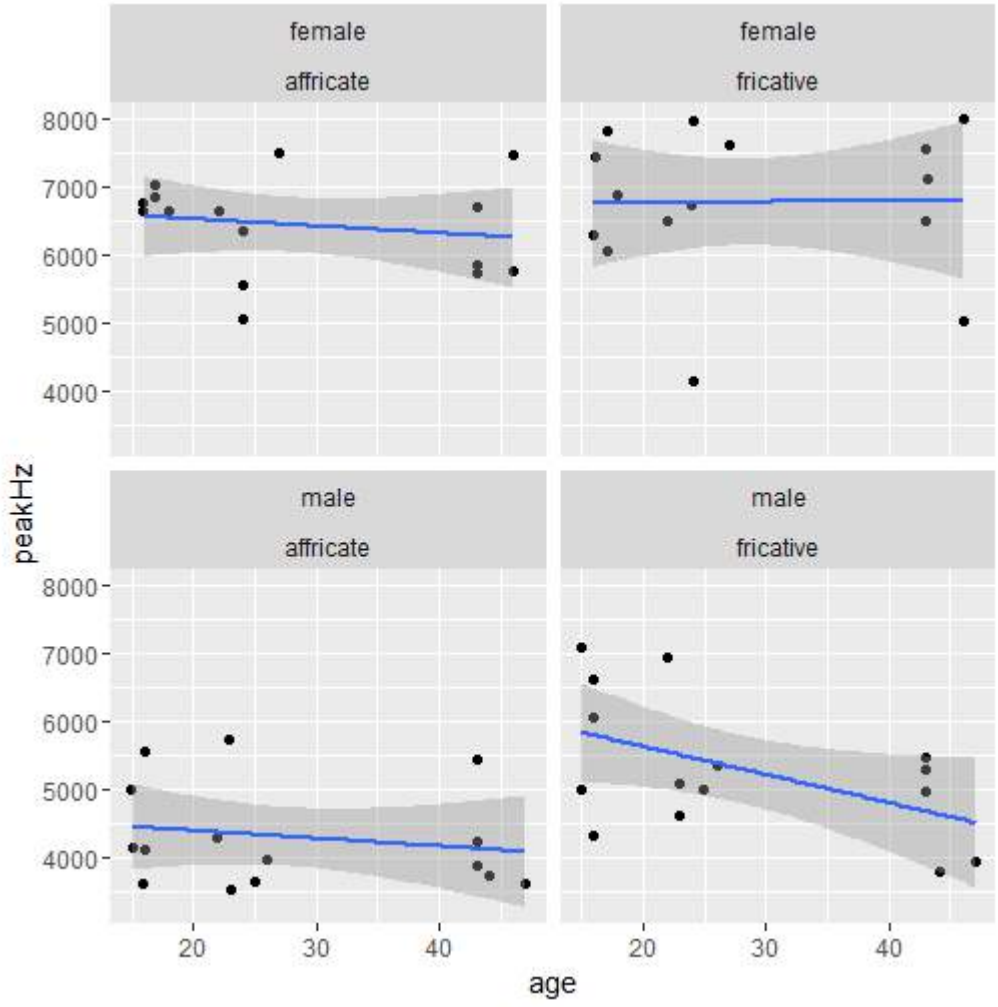

Figure 1. Mean spectral peak frequency for affricates and fricatives as a function of individual speakers' age.

Pitch-pattern diffusion of generational tone change in North Kyungsang Korean English loanwords

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North Kyungsang (NK) Korean is a pitch accent language which uses (H)igh and (L)ow tones to distinguish words (Jun et al. 2006). In the NK native vocabulary, the accented high tone is assigned lexically and its position in the word is generally unpredictable. However, unlike native words, the assignment of accent to English loanwords is sensitive to moraic structure and largely predictable in terms of syllable weight (Kenstowicz & Sohn 2001; M. Kim 2006; J. Kim 2009; Davis 2010).

The difference between NK native words and English loanwords is further seen in the pattern of accentuation when a suffix is added. Since NK Korean allows only one accented syllable in a single prosodic word [stem+suffix], if an accented stem is combined with an accented suffix, one of the accents must be deleted. In NK native words, when a word with an accent on the final syllable is combined with an accented suffix, the stem loses its accent and the accent appears on the suffix (e.g. *palám* (LH) 'wind' + *-chélem* (HL) 'like'→ *palam-chélem* (LL-HL)). However, according to Kenstowicz & Sohn (2001), NK English loanwords have a distinct tone pattern from NK native words showing that they always keep their stem accent (e.g. *leymón* (LH) 'lemon'+ *-chélem* (HL) 'like'→ *leymón-chelem* (LH-LL)).

Yet, this traditional observation described by Kenstowicz & Sohn (among others) is based on NK Korean as spoken in the 1990s and earlier, by now an older generation of speakers. Our recent observation reveals that this unique loanword pattern seems to be changing especially among a younger generation and that this variation (i.e. change in progress) has not been previously reported. To check the reality of the tonal change, a production experiment was conducted with 11 younger (born after 1985) and 10 older (born before 1965) speakers of NK Korean who have lived their lives in the NK region. The stimuli consist of one-, two-, and three-syllable final accented loanwords that end with either a CV or CVC syllable to investigate how syllable number and weight affect the tonal change.

The overall results reveal that a pitch-pattern diffusion is in progress across the board in final accented NK English loanwords when they are combined with an accented suffix. Such loanwords seem to be losing their unique tone pattern (stem accent) and are becoming more like native words, which have a suffixal accent. Although the diffusion is happening for both younger and older speakers, the degree of diffusion is different and is quite patterned, based on syllable structure and word length. For the younger speakers, most of the bisyllabic and trisyllablc loanwords have already changed to the native pattern whereas the diffusion is only beginning for monosyllabic loanwords, most of which keep their stem accent under suffixation (e.g. *khép-chelem* (HLL) 'like a cup' as in Figure 1). However, the older speakers mostly retain the traditional pattern (stem accent) as described by Kenstowicz & Sohn except for one structurally defined group of words: trisyllabic words that end with a light syllable (see Figure 1). Here, we infer that the pitch-pattern diffusion witnessed by the younger generation began with trisyllabic words ending in final light syllables since this change also occurs with the older generation.

Given the observations above regarding the similarities and differences between the two generations, we can plot the course for how the native-like pitch pattern diffusion is occurring on loanwords in NK Korean. For example, the diffusion begins with trisyllabic loanwords that end with a final light syllable, since all speakers in our current study show this pattern. Also, monosyllabic words produced by the younger speakers show that those consisting of a heavy syllable are most conservative in keeping the traditional loanword pattern of stem accent. Taken altogether, the results reflect that the change begins from trisyllabic loanwords with a final light syllable and ends with monosyllabic loanwords consisting of a final heavy syllable. That is, polysyllabic words are more affected by the diffusion, and within them, words that end with a light syllable change first.

Although in our study there was surprisingly little individual variation, we found one younger speaker whose pitch-pattern was nativized for all word categories. In his production, the diffusion was mostly done even for monosyllabic words that end with a heavy syllable. We also found some younger

speakers who kept the traditional stem accent only in highly frequent bisyllabic loanwords ending in a heavy syllable (i.e. *kheycháp-chelem* (LHLL) 'like ketchup'). The data presented here shows evidence for individual variation within this change, but in a predictable way. All in all, the results show that a pitch-pattern diffusion is in progress in NK English loanwords.

Figure 1: Representative sample of pitch pattern diffusion on final accented NK English loanwords with the accented suffix 'chélem'

Word type			Monosyllabic words		Bisyllabic words		Trisyllabic words	
Pronunciation			*khep-chelem*	*kha-chelem*	*kheychap-chelem*	*sukhi-chelem*	*chokholeyt-chelem*	*panana-chelem*
English words			'cup'	'car'	'ketchup'	'ski'	'chocolate'	'banana'
NK suffix (accented)			'chelem'	'chelem'	'chelem'	'chelem'	'chelem'	'chelem'
Expected accent pattern (stem accent)			HLL	HLL	LHLL	LHLL	LLHLL	LLHLL
Participants		Year born	Final CVC	Final CV	Final CVC	Final CV	Final CVC	Final CV
Older group	OF1	1960	HLL	HLL	LHLL	LHLL	LLHLL	LLLHL
	OF2	1964	HLL	HLL	LHLL	LHLL	LLHLL	LLLHL
	OF3	1965	HLL	LHL	LHLL	LHLL	LLHLL	LLLHL
	OF4	1965	HLL	HLL	HLLL	LHLL	LLHLL	LLLHL
	OF5	1960	HLL	HLL	LHLL	LHLL	LLHLL	LLLHL
	OM1	1960	HLL	HLL	LHLL	LHLL	LLHLL	LLLHL
	OM2	1962	HLL	HLL	LHLL	LHLL	LLHLL	LLLHL
	OM3	1960	HLL	HLL	LHLL	LHLL	LLHLL	LLLHL
	OM4	1955	HLL	HLL	LHLL	LHLL	LLHLL	LLLHL
	OM5	1962	HLL	HLL	HLLL	LHLL	LLHLL	LLLHL
Younger group	YF1	1988	HLL	LHL	LLHL	LHLL	LLLHL	LLLHL
	YF2	1989	HLL	HLL	LHLL	LLHL	LLLHL	LLLHL
	YF3	1990	HLL	HLL	LLHL	LLHL	LLLHL	LLLHL
	YF4	1995	HLL	LHL	LLHL	LLHL	LLLHL	LLLHL
	YF5	1989	HLL	LHL	LLHL	LLHL	LLLHL	LLLHL
	YF6	1991	HLL	HLL	LLHL	LLHL	LLLHL	LLLHL
	YM1	1991	HLL	HLL	LLHL	LLHL	LLLHL	LLLHL
	YM2	1996	HLL	HLL	LLHL	LLHL	LLLHL	LLLHL
	YM3	1996	HLL	HLL	LHLL	LLHL	LLLHL	LLLHL
	YM4	1990	HLL	HLL	LLHL	LLHL	LLLHL	LLLHL
	YM5	1993	LHL	LHL	LHLL	LLHL	LLLHL	LLLHL

(Note: Dark shading indicates the changing pattern; the two light shaded examples show a nonstandard underlying accent pattern on the initial syllable of the loanword rather than the final syllable; no shading indicates the conservative pattern of loanword stem accent)

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Individual differences in Kurtöp tonogenesis

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According to the established model of tonogenesis (e.g. Haudricourt 1954; Matisoff 1973, etc.), a contrast in consonant type conditions pitch on the following vowel. Voiceless onsets condition high pitch and voiced onsets condition low pitch. Once pitch has phonologized, the original contrast in voicing ceases to be distinctive. What remains unknown, however, is the detailed nature of the change; for example, we do not know if the change is instantaneous or if it slowly spreads from phoneme to phoneme and/or word to word. We do not know how speakers differ or agree in a given speech community. This current study builds on Hyslop (2009), examining tonogenesis in progress with data from five speakers. We find interesting speaker differences yet also some shared tendencies.

Hyslop (2009) has shown that in Kurtöp, tone first phonologized following sonorant consonants and then the palatal fricative and that tonogenesis is now underway following the remainder of the obstruents. In order to investigate the continued pathway of tonogenesis, a production study was designed. The study was designed to 1) compare fundamental frequency on vowels following voiced and voiceless obstruents and 2) compare presence of voicing for the phonologically voiced series of obstruents (which is now devoicing). We predict that pitch will be statistically distinct on vowels while presence of voicing for voiced obstruents will vary dramatically as the stops devoice as part of the tonogenesis process.

Five native speakers of Kurtöp produced 1416 tokens (354 words * 4 repetitions). The tokens equally represent voicing (voiced, voiceless, and voiceless aspirated) and phonetic environment was controlled for place of articulation (labial, dental, retroflex, palatal, velar) and vowel shape. Voicing was measured in word-initial position and F0 was measured at nine equidistant points on the following vowel. Results show that Kurtöp voiceless stops condition a fundamental frequency approximately 30 hertz higher than voiced stops, and that this difference is maintained over the duration of the vowel, regardless of the place or manner of the obstruent onset. Speakers are mostly consistent in this regard.

With regard to phonetic voicing in the obstruents, we find that phonologically “voiced” fricatives are devoiced approximately 60% of the time while the phonologically “voiced” stops are devoiced approximately 40% of the time. However, we also see some differences between the speakers. For two of the five speakers, the phonologically “voiced” fricatives were devoiced less than fifty precent of the time (Figure 1). Looking at place of articulation of stops, all speakers tended to maintain a distinction in VOT for phonologically “voiced” labials but for the other four places of articulation there was not consistency (Figure 2). For example, three speakers had dramatically more voiceless productions of “voiced” retroflexes while for two speakers there were more voiced productions.

Kurtöp gives us a rare opportunity to examine tonogenesis in process. In doing so we can gain insight into the nature of this sound change. The current study suggests that tonogenesis is a slow-moving process, not necessarily applying to an entire phonemic system in one step. Further, it appears that while general trends can be identified (fricatives neutralize before stops, for example), there is a large amount of inter-speaker variation that should not be ignored.

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Figures

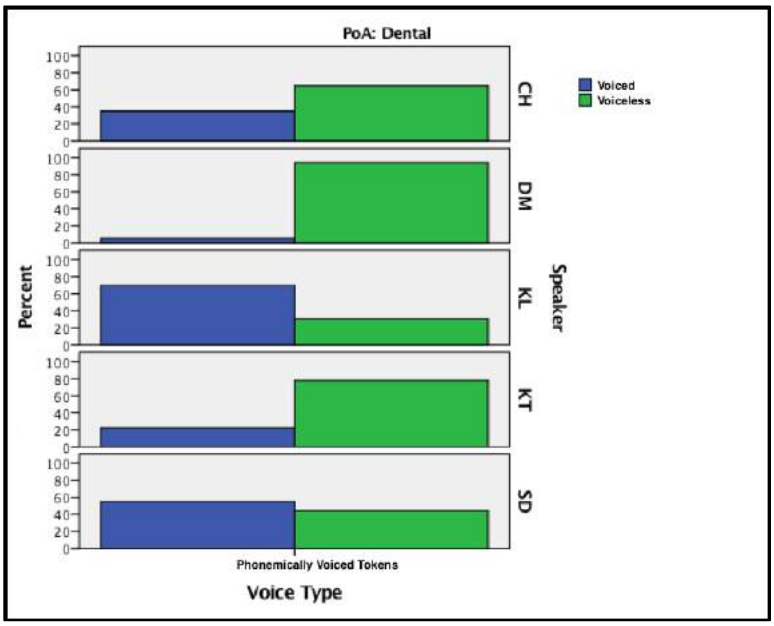

Figure 1: Phonetic voicing of "voiced" fricatives by speaker

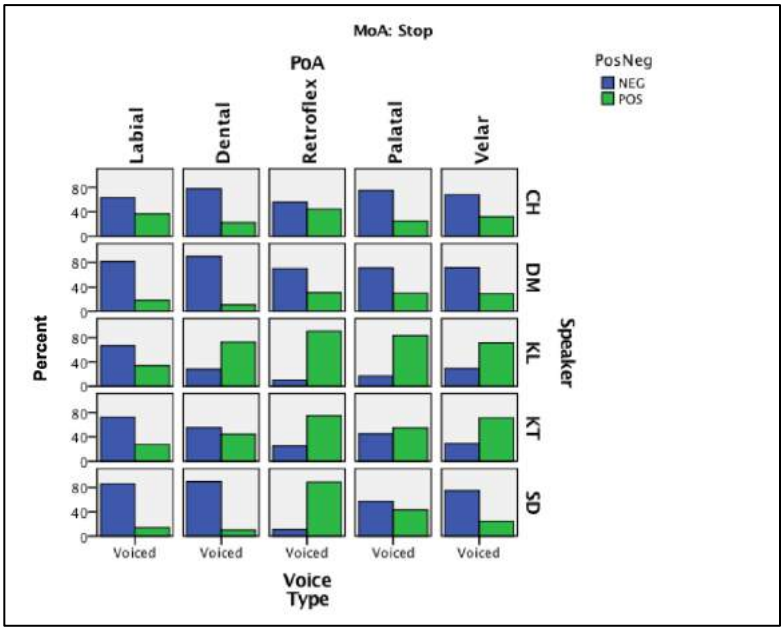

Figure 2: Percentage of positive versus negative VOT values in phonemically voiced stops, by place of articulation and speaker

Interaction between phonetics and phonology in the realization of listener-based sound change

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The diversity of the Slavic languages in the expression of the secondary palatalization contrast is an important test case for theories of the actuation and stability of sound change. Proto-Slavic had a set of contrasts between palatalized and plain consonants, e.g., /p/ vs. /p^{j}/, /t/ vs. /t^{j}/, /m/ vs. /m^{j}/, etc. (Carlton 1991). Modern Slavic languages vary from ones that maintain that contrast in at least one prosodic position (e.g. Russian, Polish, and Bulgarian), as in (1)a-d, ones that show merger in some consonants but not others (e.g. Slovak, Czech, and Macedonian), as in (1)e, and one that loses the contrast entirely (Slovenian). If there is a phonetic motivation for the contrast, the motivation needs to be rich enough to be able to account for the difference between the speaker-listeners of a diverse set of communities. Teleological explanations will not do, since what's best for one community should be best for other communities.

This work will first discuss a basic implicational typological asymmetry in which consonants are more or less likely to exhibit merger of the secondary palatalization contrast. Specifically, if the coronal stops and lateral lose the contrast, then the labials, sibilants, and rhotic will also lose the contrast. It will then be argued, based on the acoustic theory of speech production (Fant 1960, Stevens 1998), that the asymmetry is based on how the palatalization gesture is acoustically expressed in different consonants. An acoustic study of the contrast in Russian, one of the languages that maintain the contrast, will then show how predictions of the articulatory-acoustic theory are born out in cross-speaker variability in the expression of the contrast for different consonants. Twelve speakers participated in the experiment, and the data was analyzed in terms of spectral distinctiveness of the contrast, in the consonant and in the vowel transition, using SSANOVA (Gu 2002).

It will then be shown that Ohala's listener-based theory of sound change (Ohala 1981, 2012) is subtle enough to account for the initiation of the diverse contrast systems in the modern Slavic languages. Specifically, the three scenarios discussed extensively by Ohala, stability, hypocorrection, and hypercorrection, will be argued to be the observed scenarios in the languages that maintain the contrast, those with partial loss, and those losing the contrast, respectively. Moreover, the ambiguity and reconstruction underlying the speaker-listener disparities initiating sound change will be shown to be exactly the articulatory-acoustic transform ambiguities underlying the consonant asymmetry.

However, it will be argued that even though the listener-based theory is sufficient for accounting for the *initiation* of the sound change, it cannot be responsible for the *stability* of the contrast for a thousand years. The argument to be presented will be that different scenarios describing different kinds of listeners are *phonological* scenarios that stabilize and are stabilized by differences in the perceptual behavior of listeners, relying on the work of Beddor (2009, 2012) on the interplay of perception and grammar.

(1) Contrastive palatalization in Slavic languages

a. Russian: Palatalization contrast for most consonants in most environments

m-mʲ	mat	'foul language'	mʲat	'crumpled.PPL'
s-sʲ	suda	'court of law.GEN.SG'	sʲuda	'here, this way'
t-tʲ	brat	'brother'	bratʲ	'to take'
f-fʲ	krof	'shelter'	krofʲ	'blood'

b. Polish: Palatalization contrast for most consonants (with change of place) in most environments

p-pʲ	pasta	'toothpaste'	pʲast	name; 'native Pole'
m-mʲ	mɔtwɔx	'mob'	mʲɔtwa	'broom'
s-ɕ<*sʲ	sadɔvʲitɕ	'to seat'	ɕadatɕ	'to sit down'

c. Bulgarian: Palatalization contrast only in prevocalic position

b-bʲ	bal	'ball dance'	bʲal	'white'
r-rʲ	grad	'city'	brʲag	'shore'

d. Bulgarian: Palatalization neutralization in the coda

rʲ	tsar	'czar'	tsarʲat	'the czar'
nʲ	dɛn	'day'	dɛnʲat	'the day'

e. Slovak: Contrast lost in labials and fricatives, retained otherwise (with change of place)

*bʲ > b	bɛhac 'run'	*sʲ > s	sɛnɔ 'hay'
d-ʑ<*dʲ	dɛska 'plank'	ʑɛsac 'ten'	

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Resistant of Sound Change? Re-evaluating NORMs

This paper focuses on the role of individuals in speech communities from an unusual angle by asking: who are the individuals last to adapt to sound change and what is their role for the representations of a given variety? We take the point of view of cognitive sociolinguistics (cf. Kristiansen/Dirven 2008) that claims that varieties are represented in the speakers' minds in forms of prototypes, similar to non-linguistic concepts (cf. Rosch 1975). We argue that when it comes to regional varieties, *non-mobile older rural males* (NORMs, cf. Chambers/Trudgill ^{2}1998), who do not adapt that easily and eagerly to sound change, constitute the centre of such prototypes.

The paper is empirically based on the linguistic situation in Southern France. The data was collected in Toulouse and Marseille, the two major cities in the South of France that stand for the south east (with the Occitan substrat *languedocien*) and south west (with the substrat *provençal*) respectively. These two cities are associated very differently, Marseille being the city of the films of Marcel Pagnol, *pétanque* and the Mediterranean Sea, and Toulouse the city of aeronautics and rugby. All in all, the Marseille accent is a lot more present in television and therefore better known in the rest of France (cf. Kuiper 1999). The different southern French accents are today in the process of being levelled and standardised (cf. Armstrong/Pooley 2010). The sound change that is happening goes towards the Parisian norm (cf. Durand 2009), but evidence from Aix-en-Provence also shows that a supra-regional southern norm is emerging (cf. Taylor 1996). However, the southerners still claim major differences between the accents, especially between those of Toulouse and Marseille (cf. Pustka 2010). Perception tests so far have shown that it is very difficult to identify the different southern accents (cf. Coquillon 2005, Woehrling/Boula de Mareüil 2005, Pustka 2010). These tests can yet only be regarded as pre-studies because of their small number of stimuli and participants.

For our own study, we used interviews and questionnaires to examine the representations of the two urban accents and conducted an online accent identification test. The test consisted of 216 read stimuli from 72 speakers (3 stimuli per speaker, from 3 to 17 s long), a quota sample from Marseille and Toulouse. 177 participants who lived mostly in the south of France had to guess the origin of the speakers with the answer categories 'Toulouse', 'maybe Toulouse', 'Marseille', 'maybe Marseille', 'I don't know'. An additional offline test was conducted in Toulouse and Marseille with 100 participants who listened to a subsample (24) of the stimuli.

The results show that although the participants claimed to be able to differentiate between the two urban accents, they could not allocate the speakers to their cities. Instead, those speakers who were thought to be *Marseillais* are those who correspond to the concept of NORMs, whereas the opposite, younger more educated female speakers were thought to be *Toulousaines*. We can derive from this that social markers were reinterpreted in geographical terms, just as in Boughton's 2006 study about northern French where working class was associated with the North East and middle class to Paris and the West. We suggest that this result can be interpreted as a new argument for the *Marseillais* accent as the centre of the prototype of southern French.

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Phonetically gradient dissimilation: evidence from Aberystwyth English

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Dissimilation is classically considered a phonetically abrupt sound change (Hock 1991). Ohala's (1981, 1992, 1993) widely accepted hypercorrection theory accounts for this categoricality by defining dissimilation as a misinterpretation of the signal by the listener. Contrary to these expectations, this study presents evidence for a gradient dissimilation pattern found in Aberystwyth English (Wales). This data is compared with two other patterns of gradient dissimilation recently reported in the literature, Mongolian (Svantesson et al. 2005, Svantesson & Karlsson 2012) and Georgian (Begus 2016). This behaviour may then be seen as another path to dissimilation, potentially stemming from motor planning (Garrett 2015), or as a strategy to preserve unambiguity in the signal.

In Ohala's Coarticulation Hypercorrection Theory (as named by Bye 2011), dissimilation arises when coarticulation in the speech signal is misinterpreted by the listener through hypercorrection. For example, in the regressive aspiration dissimilation known as Grassmann's Law in Ancient Greek, Proto-Greek /tʰrikʰos/ 'hair' GEN. sg. would be produced as [tʰr̤i̤kʰo̤s]. The aspiration/breathiness pervading the word may then be misinterpreted by the listener as a coarticulation effect, originating in the /kʰ/, and the perceived [tʰr̤i̤kʰo̤s] can be reconstructed by the listener as /trikʰos/. Dissimilation is predicted to be categorical, since it affects distinctive features in the underlying form; and it crucially relies on (the listener's expectation of) coarticulation.

Contrary to these predictions, the aspiration feature of stops in Aberystwyth English (AE) is gradiently reduced when preceded by another aspirated stop or /h/ ('SG' in Figures), that is, where it is most likely to create ambiguity in the signal. Fortis stops in AE are both pre- and post-aspirated, as in *weapon* ['wẹ̝ʰpʰə̝n] (Hejná 2015) (see also Fig. 1 here); the same has been found for Manchester English (Hejná & Scanlon 2015) and Welsh (Morris & Hejná, in prep; Iosad, pc). CVC structures in which the intervening vowel is surrounded by fortis stops, as in *tip* [tˢʰɾʰpʰ], or by /h/ and a fortis stop, as in *hip* [hrʰpʰ], are then most likely to show coarticulation. Interestingly, however, phonetic measurements based on 12 English speakers from Aberystwyth (550-620 tokens per speaker) show that the degree of pre-aspiration of C_2 in C_1VC_2- sequences depends on the quality of C_1: the intervening vowel shows less breathiness and pre-aspiration and shorter intervals of breathiness and pre-aspiration, when C_1 is a *fortis* stop (/p, t, k/, as in *tip*) or /h/ than when it is a *lenis* stop (/b, d, g/, as in *dip*) or a sonorant (as in *lip*). The difference is significant for both breathiness and pre-aspiration (Fig. 2 and 3). Measurements of the breathiness of the intervening vowel also show that complete coarticulation between both aspiration features is very rare. Analyses of the overall noisiness of the vocalic interval will be conducted via Cepstral Peak Prominence in order to evaluate the degree of coarticulation via noisiness level (rather than just durational and occurrence-related properties).

The gradient reduction of aspiration does not seem to be limited to AE: two other related patterns are reported in the literature. In Halh Mongolian, the post-aspiration of C_1 in C_1VC_2-sequences is significantly shorter before pre-aspirated stops than before other consonants: $\underline{C}^{h}V^{h}C$- (Svantesson et al. 2005, Svantesson & Karlsson 2012). In Georgian, where aspirated stops are post-aspirated, Begus (2016) finds a reduction of the aspiration feature of C_2: $C^{h}V\underline{C}^{h}$. While it is unclear now whether these three patterns stem from the same cause, they suggest that gradient dissimilation patterns of aspiration features are well attested cross-linguistically.

Finally, we discuss the theoretical implications of this data. On the basis of the Mongolian evidence, Garrett (2015) proposes to see the gradient reduction of aspiration as another possible precursor to categorical dissimilation. Interestingly, other dialects of Mongolian have undergone a categorical dissimilation. One could then speculate that aspiration reduction in Halh is precisely what prevented categorical dissimilation in this dialect. Garrett also suggests that the reduction of the first aspiration gesture would arise from gestural organization or motor planning (Garrett & Johnson 2012). We discuss the question whether the AE data fits the predictions made by this hypothesis.

Fig. 1. Distinction between breathiness ('br') and pre-aspiration ('pre').

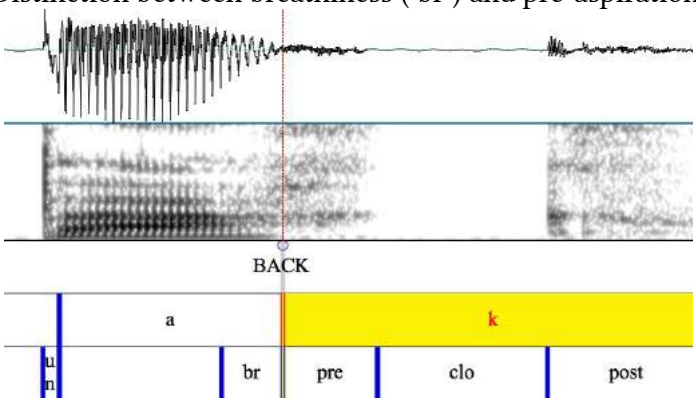


Fig. 2. Gradient dissimilation related to the occurrence of pre-aspiration and breathiness.

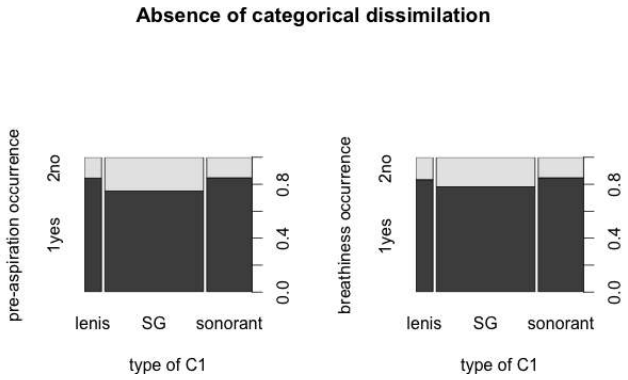
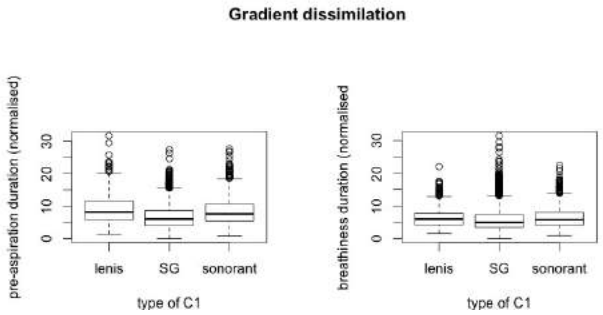


Fig. 3. Gradient dissimilation related to the duration of pre-aspiration and breathiness.



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Rhotic variation and change in two Scottish localities

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Scottish English is typically described as a rhotic variety of English in which /r/ is articulated in prevocalic as well as non-prevocalic position. The typical realizational variants are said to be alveolar taps and postalveolar or retroflex approximants, which several studies conducted in Edinburgh, Glasgow, or Ayr have confirmed since the late 1990s. Alveolar trills are now rare in Scotland, especially in informal conversational speech. In addition to these consonantal realizations, partial or full vocalization of /r/ has been observed in non-prevocalic position in working-class speech, particularly among young male speakers. This is most frequent in Glasgow, but such vocalization has been noted in Edinburgh and Ayrshire too. Middle-class speakers seem barely affected by this innovative realization, and remain largely rhotic, which creates a sharp divide in that respect between the two social classes.

Although there has been a large number of studies conducted on Scottish English /r/ since the late 1970s, the focus was mainly on the urban centres of the Central Belt of Scotland, namely Glasgow and Edinburgh and their neighbouring towns, or on marginal towns along the Scottish-English border. Furthermore, most studies concentrated on working-class speech in these localities.

This study focuses on the phonetic realization of /r/ in two localities that are not in the immediate influence of any of the two urban centres of Glasgow and Edinburgh, and that offer a comparative opportunity in terms of urban and population size and of location. The first locality is Dundee, a secondary urban centre in Scotland, the fourth city in terms of population size (about 150 000 inhabitants). The second locality is Kinross, which is a small rural town located in Perth and Kinross, between Dundee and Edinburgh. Middle-class speakers from both locations were recorded : 15 speakers from Dundee and 14 speakers from Kinross, each group being composed of two subgroups in terms of age and gender. Social class was established from the occupation of the speakers or from that of their parents for students. Indeed, all speakers were recorded in a quiet room in a high school while reading a list composed of 132 words with a phonological /r/ plus 29 distractors. The realizations of /r/ was coded with the Praat software on the basis of the signal and the typical properties of sounds (frictions, occlusions, formant variation and structure, etc.). Differences based on linguistic factors (phonological environment, phonetic environment, syllable stress, lexical frequency) and social factors (age, gender, national identity, geographical origin) were examined and statistically tested.

Results confirm first that /r/ is extremely variable and second that both linguistic and extralinguistic factors influence the realization of this phoneme in Scottish English. The observed variation is not random, and the phonological environment of /r/ and the geographical origin of the speaker are particularly significant. Alvolar taps are more frequent in intervocalic and postconsonantal position, while post-alveolar approximants are more frequent in initial position and in preconsonantal position. Results differ greatly between speakers from Dundee and speakers from Kinross, the former being overall more conservative in their use of rhotics, as alveolar taps and trills are more frequent than for the latter speakers, who produce approximants more often. This is particularly the case for the young women from Kinross, who very rarely produce taps instead of approximants. The apparent time construct suggests a sound change in progess from conservative (taps and trills) to more innovative (approximants) types of rhotics. Gender, syllable stress, and phonetic environment are also significant in several environments. These results indicate that although middle-class speakers remain essentially rhotic, they too are exhibiting a sound change regarding their use of rhotics, and that the change is more advanced in the locality closer to the Edinburgh urban area, suggesting a wave-like model of spatial diffusion.

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The role of linguistic input in children's perception of vowel changes in progress: The FACE and GOAT vowels in York

There is an ongoing rise in the use of the southern diphthongal variants of the FACE and GOAT vowels ([eɪ] and [əʊ]) in Central North regions of the UK. Haddican et al. (2013) report this as a change in progress in York, where adults associate the 'mainstream' (Watt, 2002) local variants ([e:] and [o:]) with working class speakers in the local community. Haddican et al. found that speakers from York who identified more with the local community were more likely to use the monophthongal variants themselves.

Research shows that there is an 'adolescent peak' (Labov 2001), whereby 15-17 year-olds use higher rates of incoming linguistic changes than pre-adolescents and post-adolescents. Therefore, young children are not usually considered in the description of the production and perception of sound change. However, many important sociolinguistic skills are developing in children from a pre-school age. Ages 3-4 are 'critical' for language learning in general, including the learning of variation (Roberts and Labov 1995).

The present study tested children's ability to perceive the different variants of two ongoing sound changes in their local community. Pre-school and primary school children in York were asked to group speakers based on their monophthongal or diphthongal pronunciation of the FACE and GOAT vowels.

The results found that both groups of children scored above chance (50%) at grouping speakers according to these phonological variables and that the primary school children performed particularly well in this task (77% correct answers). Overall, children with more exposure to non-Yorkshire English speaking family and friends performed better in this task (see Figure 1). This indicates that children's individual exposure to variation in their linguistic input plays a role in their perceptual awareness of these phonological distinctions. This interpretation is further supported by the finding that amongst the top eight scorers, there were three pairs of siblings, who are likely to have experienced a very similar linguistic input from their parents, family and family friends. Furthermore, all of the top eight scorers had at least one parent with a postgraduate education, which was a measurement taken as an indication of the children's social class. Children from higher class families are likely to be exposed to more standard forms at home, which contrast with the mainstream accent features of their local community. Therefore, they are likely to be exposed to more variation overall.

These results highlight the role of an individual's experience in perceiving a sound change in their community. The results are interpreted through a usage-based model of language acquisition (Tomasello 2003) in which experienced exemplars are stored on encounter and then later accessed in speech processing (Foulkes and Hay 2015).

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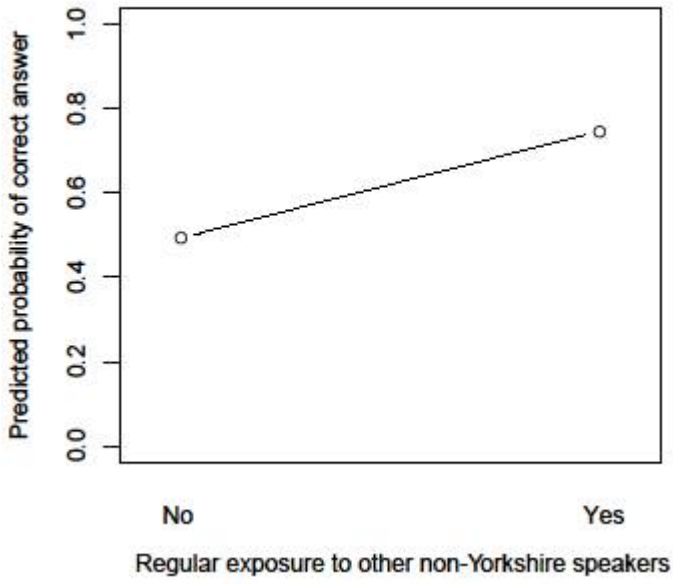

Figure 1: Model prediction showing the effect of children's regular exposure to other regional varieties

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The Production-Perception link in tonogenetic sound change in three dialects of Korean

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Introduction: Multiple dialects of Korean are reported to be undergoing a sound change where the primary acoustic correlate of the laryngeal contrast in stops (lenis vs. aspirated) is shifting from VOT to f0 on the following vowel. In this paper, we examine the production and perception of stop laryngeal contrasts by 189 Korean speakers/listeners from three dialects of Korean representing different stages of VOT-to-f0 change in order to investigate the link between production and perception in sound change in progress.

Hypothesis: While most theories of sound change recognize the complementary role played by production and perception in sound change, theories differ in their emphasis on one or the other as the primary driver of change (Ohala 1991, Beddor 2009, Lindblom et al. 1995, Bybee 2001). Based on a working assumption that the proposed mechanistic difference (primacy of perception vs. production) may manifest itself as difference in relative timing between change along the two modalities, we generate the following predictions.

1) If a sound change is perception driven, perception should change ahead of production.
2) If a sound change is production driven, production should change ahead of perception.
3) If production and perception are tightly linked, perception and production should change in tandem.

Data: Speakers/Listeners of Seoul Korean (n=65) and two Chinese dialects of Korean, Dandong (n=64) and Hunchun (n=60), balanced for gender and age (born 1932-1996), participated in a production experiment (word reading) and a perception experiment (3-way forced choice between lenis, fortis, & aspirated stops). Production stimuli consisted of two repetitions of 18~36 stop initial words balanced for place and laryngeal features (fortis, lenis, aspirated). VOT and f0 at vowel midpoint were measured. Perception stimuli were created from natural productions of one older male and one younger female talker (chosen to capture the purported ends of the conservative-innovative spectrum in sound change), with VOT and F0 manipulated to vary within each speaker's natural production range (VOT: 8 steps (0~100 ms); F0: 5 steps (male: 135~200 Hz, female: 200~335 Hz). Stimuli from the two speakers were presented in separate blocks.

Analysis: To allows for comparison of cue use across speakers and across modalities, production VOT and f0 values were z-score transformed for each speaker and similarly, the VOT and f0 values of the perception stimuli were normalized by each talker. Figure 1 summarizes stop distribution in the normalized VOT*f0 acoustic space in the three dialects. Hunchun is the most conservative with aspirated and lenis stops distinguished almost entirely by VOT, while Seoul shows the most advanced stage of change with the two stops primarily distinguished by F0, and Dandong shows an intermediate pattern. To test whether dialect-internal change is taking place in VOT and F0 in production and perception and compare the trajectory of change across the two modalities, we built separate linear mixed effects models for VOT and f0, and for production and perception. For perception, separate models were built for male and female talkers. All six models showed a three-way significant interaction of lar * yob * dialect, indicating that age-based variation (i.e., change) is not uniform across dialects, and a post-hoc test was conducted to see which dialect show a change in progress (i.e. significant interaction of lar * yob) for each variable for each modality (results summarized in Table 1; visualizations in Figure 2).

Results: Cross-dialect differences are consistent across production and perception: f0 is used most in Seoul and least in Hunchun, while VOT shows the opposite pattern, with Dandong speakers showing intermediate use of both cues. In terms of within-dialect variation, production data point to a robust change in progress in Seoul and Dandong (with younger speakers using more f0 and less VOT), but this is not the case for Hunchun. These production changes are reflected in age-based variation in perception of the older male talker (change found in Seoul and Dandong but not Hunchun), but interestingly, perception of the younger female talker deviates from the production patterns, with age-based modulation of reliance on f0 and VOT in Dandong and Hunchun, but **not** Seoul. These findings support Model (i) above, where change in perception actuates sound change and precedes change in production. In Hunchun, there appears to be incipient change in perception preceding change in production; on the other hand, in Seoul, where the sound change is nearing completion in production, perception (of the female talker) has already stabilized. In summary, we found an overall congruence between perception and production, but crucially, we also found evidence that change in perception (of a younger, female talker) starts before change in production, and that the end point of sound change may occur sooner in perception than in production.

Figure 1: Distribution of stops in VOT*f0 space (top: production, bottom: perception)

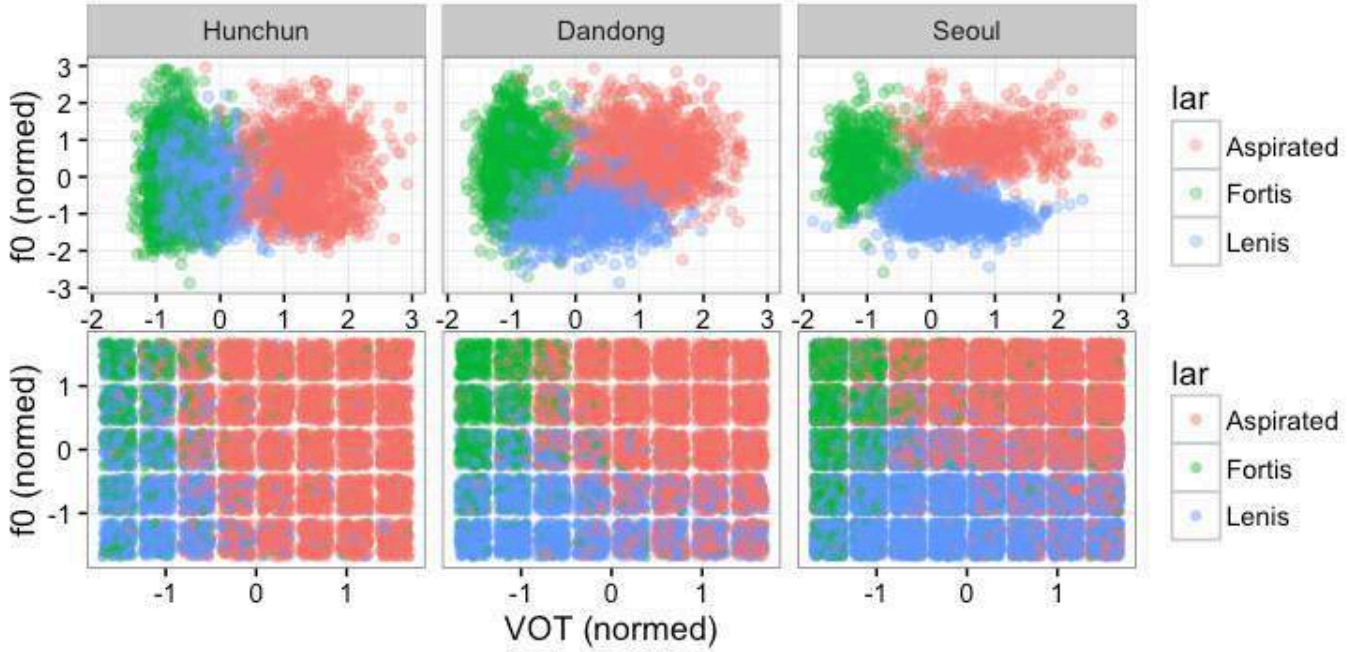

Figure 2: Use of f0 (top) and VOT (bottom) in distinguishing the Aspirated-Lenis contrast across age, dialect, and modality. Points represent individual speakers; line type indicates significance of change in use of the cue across ages.

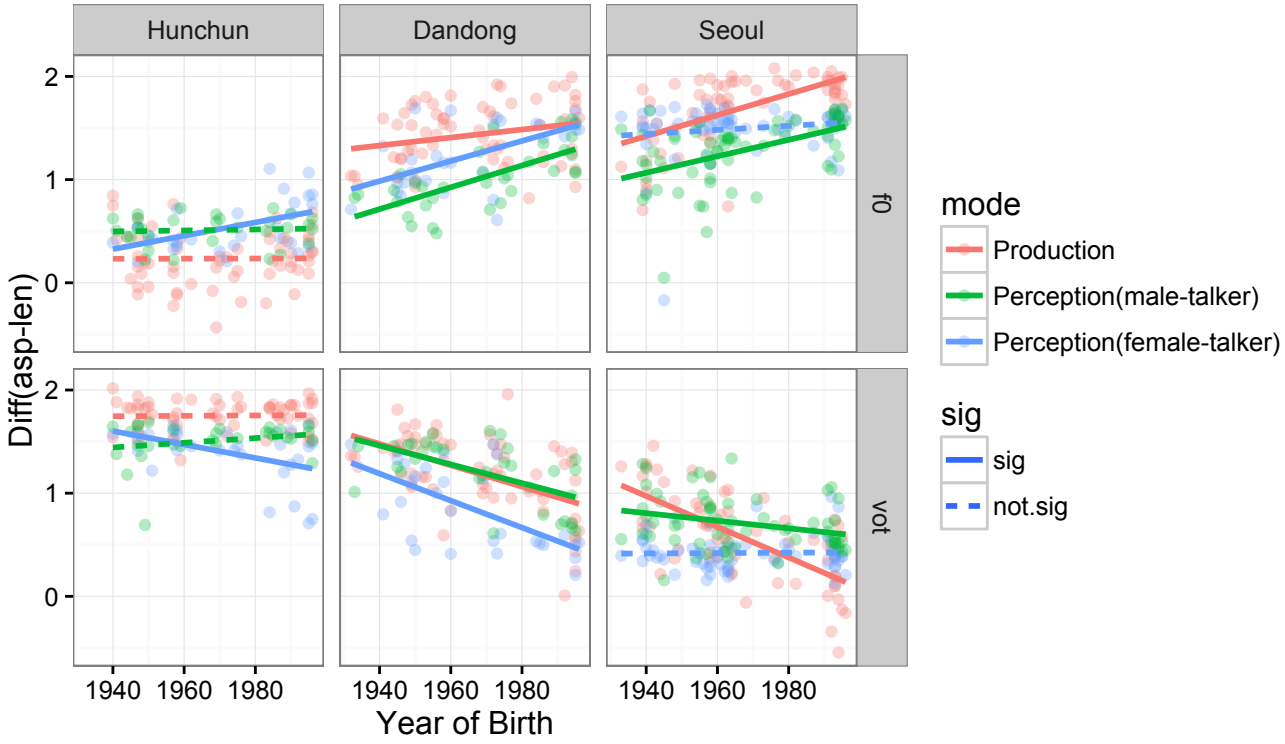

Table 1: Age (=yob) effect on aspirated-lenis contrast across dialect and modality

		Hunchun	Dandong	Seoul
F0	Production	n.s.	**	***
	Perception (Male talker)	n.s.	***	***
	Perception (Female talker)	***	***	marginal
VOT	Production	n.s.	***	***
	Perception (Male talker)	n.s.	***	*
	Perception (Female talker)	***	***	n.s.

(n.s. >0.1, marginal <0.1, * <0.05, ** <0.01, *** <0.001)

Prosodic accommodation as a driver of sound change: accommodation in Seoul Korean Accentual Phrase

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Previous research has suggested that the spread of sound change may be explained in part by individual imitation of, or accommodation to their interlocutor's speech (Ito, 2001; Trudgill, 1986). Many studies have shown that speakers alter the phonetic details of their speech in response to an interlocutor, but only a few studies have examined prosodic accommodation and these report mixed results (D'Imperio et al., 2014; NíChiosáin, 2007; Cole & Shattuck-Hufnagel, 2011). The present study begins to examine individual differences in prosodic accommodation as a driver of sound change by examining accommodation in the f0 contours associated with a prosodic boundary, the Accentual Phrase (AP) boundary in Seoul Korean (SK). The main hypothesis is that SK speakers exposed to the manipulated prosody of a model speaker (test group) will produce significantly different intonation patterns compared to SK speakers exposed to the original (unmanipulated) prosody of a model speaker (control group).

Twenty-five female native speakers of SK participated in a sentence completion task. In the first half of the experiment, participants silently read the incomplete sentences before producing the completed sentences, establishing baseline productions (Table 1). In the second half of the experiment, participants were divided into test and control groups. Each group listened over headphones to sentences recorded by a SK model speaker and then produced the completed sentences. The 11 control group speakers heard unmodified stimuli produced with the AP-final rising (LH) intonation pattern that is a characteristic feature of SK (Jun, 1993). The 14 test group speakers heard a manipulated version of the stimuli, in which the f0 peak in the AP-final rise was lowered by 20%. Original stimuli were otherwise unchanged. After the experiment, all participants filled out an exit survey that asked for their language background and rating of the model speaker.

A series of statistical analyses were conducted for each group on their f0 measurements (f0 maximum, minimum, mean, and range) taken in the final syllable of all sentence-medial APs.
The results of the Linear Mixed Model analyses showed significant differences between the two groups in that 10 out of 11 control group speakers did not differ as a function of condition (baseline vs. test) while the test group overall had significant effects of condition (Figure 1). Paired t-tests conducted for individual speakers in the test group revealed individual patterns of accommodation. Nine out of 14 speakers in the test group lowered their f0 in the AP-final syllables, to varying degrees, after being exposed to the artificially manipulated prosody with lower f0 in the AP-final syllables. The remaining five of the test group did not show post-exposure f0 lowering (although two showed an effect of f0 range). The responses to the exit survey indicated that three of the nine 'convergence' speakers, and three of the five 'neutral' speakers, noted that the model speaker sounded like a SK speaker.

Overall, the results indicate that a phonetically manipulated intonation pattern associated with a prosodic boundary induces speech accommodation in some speakers – accommodation that, in natural settings, would arguably have the potential to contribute to sound change. The results of this study may

also provide insight into the current diversity of prosodic systems among Korean dialects in which, for example, the Hamgyong and Kyungsang dialects differ in lexical pitch accents, and SK and Cholla dialects differ in the AP intonation patterns (Jun, 1993; Yeon, 2012).

Context sentence	*"Ahn Mina is four years older than Ahn Yuri."*
	anmina-nun # anyuri-pota # nesalina # naiga-manta
	Ahn Mina-Subj # Ahn Yuri-than # four-year # age-more
Target sentence	*"Therefore Ahn Mina is (Ahn Yuri's older sister)."*
	kuromuro # anmina-nun # (anyuri-poda # unnita)
	Therefore # Ahn Mina-Subj # (Ahn Yuri-than # oldersister)

Table 1. Example of a pair of sentences. The parenthetical portion was not provided to the participants in the experiment. The pound sign (#) denotes AP boundary.

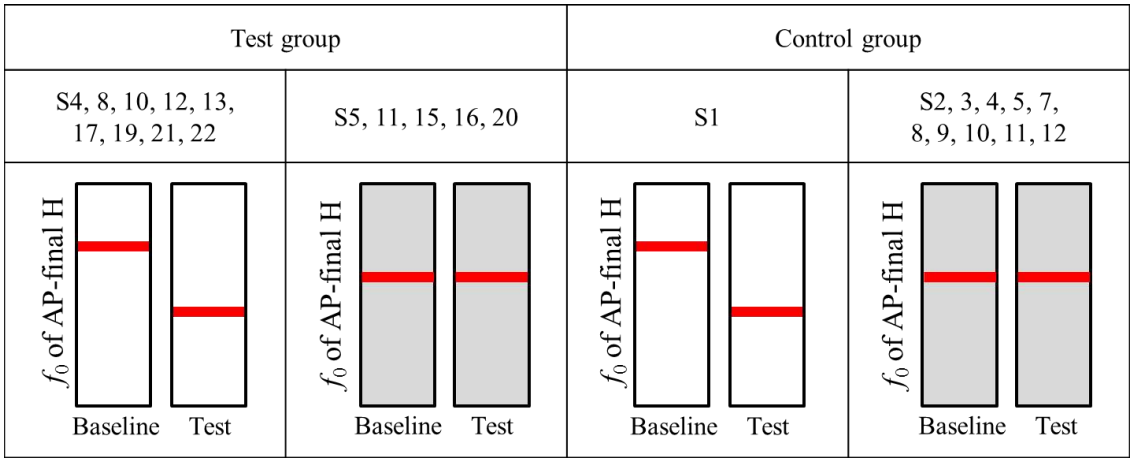

Figure 1. Schematic summary of the results. The difference between the red lines in the two boxes in a panel indicates the presence (white boxes) or absence (gray boxes) of significant effect of accommodation within each group.

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The role of articulatory settings in explaining apparent contradictions in the order of diffusion of sound change

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In the history of many languages, voiceless consonants typically undergo voicing when surrounded by sonorants. This process, dubbed *passive voicing*, means that "stops can be voiced during most or all of closure if they occur in the context of sonorant sounds, even if there are no active voicing gestures" (Jessen & Ringen, 2002, p. 190). There is an aerodynamic explanation underlying this change. Provided that closure duration be relatively short, there is not enough time to develop a gesture of glottal spread, and the vocal folds remain fairly close to each other. Given the shortness of the stop, oral pressure (P_o) level rises only to a very limited extent, so a positive transglottal pressure (P_t) is maintained, which suffices to keep the ongoing laryngeal vibration (Westbury & Keating, 1986).

The aerodynamic basis of the passive voicing justifies its order of diffusion regarding place of articulation: labials are first affected, then coronals, then dorsals. As can be noticed, this is just the opposite order to passive devoicing. For posterior places, the volume of the cavity behind the closure is smaller and P_o is higher, thereby jeopardizing the attainment of the necessary transglottal pressure drop. On the other hand, anterior places allow a greater volume of the oral cavity and, consequently, a lower P_o and a higher P_t (Blevins, 2004; Laver, 1994; Locke, 1983; Westbury & Keating, 1986). Typological surveys of phonemic inventories show that /b/ is more frequent than its voiceless counterpart /p/, whereas /k/ is more frequent than /g/ (Maddieson, 2006; Mielke, 2009).

However, Bustos Tovar (1960) and Recasens (2002), drawing from the history of Spanish, notice some contradictory cases, in which dorsals are the first type of segments affected by passive voicing. In order to solve this apparent paradox, I propose that it is necessary to consider the interaction between aerodynamic factors and long-term articulatory settings of the language. More specifically, the overall tension settings of a language determine a maximal level of P_o that can be tolerated before an excess of pressure forces the release of the articulatory contact. If those settings are moderately lax, and given that oral pressure build-up is faster for a dorsal than a labial stop, it may be the case that only the dorsal develops such P_o as to reach the tolerance threshold and undo the closure. The subsequent air leakage may cause a recovery of the P_t level that is necessary for voicing to occur. This account predicts that, when passive voicing affects dorsals first, it must be accompanied by (previous) spirantization, which is actually the case in Spanish.

A framework that explicitly includes articulatory settings into the explanation of sound change may thus be more comprehensive and offer better explanatory adequacy when it comes to interpreting the order of diffusion of such changes.

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Indexical sensitivity and the leaders of linguistic change

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The fact that linguistic innovations tend to propagate with a recurrent set of social dynamics has led researchers to investigate the profiles of the leaders of linguistic change. The findings of Milroy & Milroy (1985), Eckert (2000), and Labov (2001) suggest that innovative speakers tend to be from marginal social groups, while the individuals who facilitate the spread of innovations tend to be female members of the professional working class with diffuse social ties. These early adopters of linguistic change tend to have a history of non-conformity, reflected in their adoption of innovative linguistic forms, but remain central members of their immediate social networks, allowing their linguistic influence to spread. More recently, scholars have sought to link these social traits to individual differences in perceptual compensation for coarticulation (Yu, 2010). Additionally, it has been argued that the early adopters of linguistic change may have a higher propensity to accommodate to the speech patterns of other talkers, facilitating the adoption and propagation of novel forms (Yu et al., 2013). This poster explores another characteristic which may be important to the propagation of sound changes: *indexical sensitivity*, which is defined as an individuals propensity to notice subphonemic variation and assign it social meaning. Two hypotheses are put forward: firstly, that some individuals are generally more attuned to phonetic variation as a social cue in perception that others; secondly, that those individuals are likely to be among the early adopters of phonetic innovations in their speech community.

These hypotheses are evaluated through an analysis of the perception and production of /u/ and /o/ fronting in York, Northern England. Production data come from word list and map task recordings from 52 speakers stratified by age and socioeconomic status. Perception data are drawn from an experimental task in which listeners matched semisynthetic word tokens to a set of characters representing a range of social dimensions, including age, socioeconomic status, and urban/rural identity. The data allow a measure of sensitivity to be calculated for each individual, reflecting the degree to which each vowel variant influenced their selections on each social dimension. Individuals varied considerably in the degree to which their responses were affected by the speech stimuli, and sensitivity measures were significantly correlated within individuals, providing support for the first hypothesis: a listener who is sensitive to one vowel or social dimension is likely to be sensitive across the board.

With regard to the second hypothesis, linear mixed-effect models suggest a small but significant relationship between indexical sensitivity and speakers degree of /u/ fronting ($p<0.02$). Figure 1 visualizes this effect, demonstrating that the speakers who are most advanced in production include *both* those who have very high indexical sensitivity scores *and* those with very low scores, while the most conservative speakers are *exclusively* those with low indexical sensitivity scores. It will be suggested that this may reflect the role of two types of speaker-listener in the propagation of /u/ fronting in this community: those who advance the innovation through primarily mechanistic processes, and those who facilitate the spread of this innovation by assigning it social meaning and adopting it as a marker of social identity.

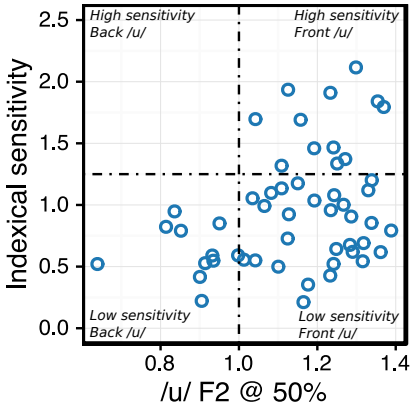

Figure 1: Indexical sensitivity as a function of midpoint /u/ F2

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A study of the role of articulatory and social factors in coda /r/ lenition

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We report on a study looking at the roles of articulatory phonetic and social factors in the loss of coda /r/ in Central Scottish English. The social stratification of rhoticity strength in the Scottish Central Belt has been noted for many decades now (Speitel and Johnston 1983, Stuart-Smith 2007, Lawson et al. 2008, Jauriberry et al. 2012). However, it seems to be a case of /r/ weakening in vernacular speech, while middle-class speech remains strongly rhotic, rather than working-class adoption of nonrhotic forms from Anglo English. Nonrhotic anglicized variants were initially found in middle-class speech in studies in the 80s, but are less common in present-day middle-class speech (see Speitel and Johnston 1983:§14). The articulatory mechanism(s) that underlie /r/ weakening have remained unclear to date. The present study investigates the possibility that a delayed anterior lingual gesture in coda /r/ production results in auditorily weak /r/ variants. Recasens and Farnetani (1994) previously noted that the alveolar gesture of phrase-final /l/ in Catalan and American English occasionally occurred partially or completely after the offset of voicing, leading to apparent loss at the acoustic level, if not at the articulatory level. A similar phenomenon has been observed for Dutch /r/ (Scobbie and Sebregts 2011, Scobbie et al. 2009).

We investigated the contribution that anterior lingual gesture delay might be making to the lenition of postvocalic /r/ in working-class Scottish English, comparing the timing of the anterior lingual gesture in /r/ in the speech of working-class speakers and middle-class speakers. We used a socially-stratified, audio-ultrasound corpus of adolescent Glaswegian English (16 speakers). Auditory strength of rhoticity was quantified for all tokens of /r/ using a Praat-based rating experiment. Articulatory measures involved quantification of the temporal difference between the maximum of the anterior lingual /r/ gesture and either the offset of voicing in CVr words: *bar, bore, fur*, or the onset of a following labial consonant in CVrC words: *farm, herb, burp*. This articulatory measure we refer to as "lag". We considered both voicing offset and final consonant onset to be events that could auditorily mask the /r/ articulation to some extent. We also measured F1-F5, at, or as close as possible to, the articulatory anterior /r/ maximum.

Correlation tests showed a strong negative correlation between articulatory lag and /r/ index score; a strong negative correlation between /r/-index score and F3 and a strong positive correlation between lag and F3. In other words, longer lags correlate with a higher F3 and a lower rhoticity-index score (weaker /r/). Linear mixed effects analysis showed that both social and linguistic factors significantly affect lag in our corpus. Working-class speakers have a positive lag that is significantly longer than that of middle-class speakers, who tend to have a short, negative lag. The presence of a pre-rhotic checked vowel /ɪ, ɛ, or ʌ/ results in a significantly shorter, negative lag for /r/, than the presence of a pre-rhotic nonchecked vowel. There was also a significant interaction

between speaker social class and the presence of prerhotic checked vowels in the stimuli. This latter result is likely due to the presence of covert, bunched articulatory /r/ variants in the speech of the middle-class participants, as /r/-bunching has previously been shown to have a strong coarticulatory effect on preceding /ɪ, ɛ, ʌ/, resulting in vowel-consonant coalescence to [ɚ˞] (Lawson et al. 2013).

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Evidence of sound change in British English crowdsourced using the 'English Dialects App'

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Traditional data collection methods in dialectology and variationist sociolinguistics have difficulty in gathering sufficient quantities of data from a sufficient range of localities to map variation at a national scale: dialectological surveys typically sample few informants per locality; sociolinguistic interview corpora typically sample a relatively low number of localities. By contrast, online surveys, whether browser-based or in the form of smartphone apps, allow researchers to gather much larger quantities of data very quickly. Such methods also typically achieve very different samples of the population than traditional methods: where traditional methods are often biased towards NORMs, or at least to non-mobile individuals, digital survey respondents are typically younger, more mobile and more educated than the population at large.

We present results from data collected through such a smartphone app, the 'English Dialects App' (EDA; Leemann, Kolly, Britain 2016), which surveyed English speakers in the British Isles. In the model of previous apps and websites for other language areas such as Leemann & Kolly (2013), Katz & Andrews (2013) and Leemann et al. (2015), EDA asks the user 26 questions about their language use and uses their responses to predict their locality of origin. Users are then invited to submit their actual locality of origin and other metadata to accompany these data; EDA gathers richer metadata than any previous comparable survey, asking respondents about their and their parents' education, mobility, age, gender and ethnicity. The EDA prediction function was originally based on the Survey of English Dialects (SED; Orton & Dieth 1962) and later updated to reflect the distribution of usage in the first 30K responses.

Using these data, we will present findings on sound change in modern British English. While lexical and morphological variables, such as the word for 'splinter' ('splinter' vs 'spell' vs. 'spelk', etc.) and the 3sg. present (-s vs. -Ø vs. do-support) are found to be highly levelled, phonological and phonetic variables are more resistant to levelling but show different rates of levelling in different broad regions. Variants associated with the south west and south coast are highly levelled, with the majority of respondents typically reporting SSBE usage. Salient variants which distinguished the English of the north of England from the south show a more mixed picture, with the FOOT-STRUT split isogloss moving northwards (see Figure 1), for example, but the TRAP-BATH split isogloss robustly maintained (see Figure 2). The north east of England, especially the conurbations of Newcastle, Sunderland and Middlesbrough, show especially high rates of non-standard forms, with traditional local variants consistently found to be the modal response across many variables.

We link these regional trends to demographic differences. In the south, where levelling is most dramatic, geographical mobility is relatively high, and there has been a major process of de-urbanization over recent decades. We propose that this mobility is key to explaining regional differences: levelling takes place in urban areas where dialect contact takes place, and de-urbanization transports these levelled varieties back to rural areas which once maintained distinct dialects.

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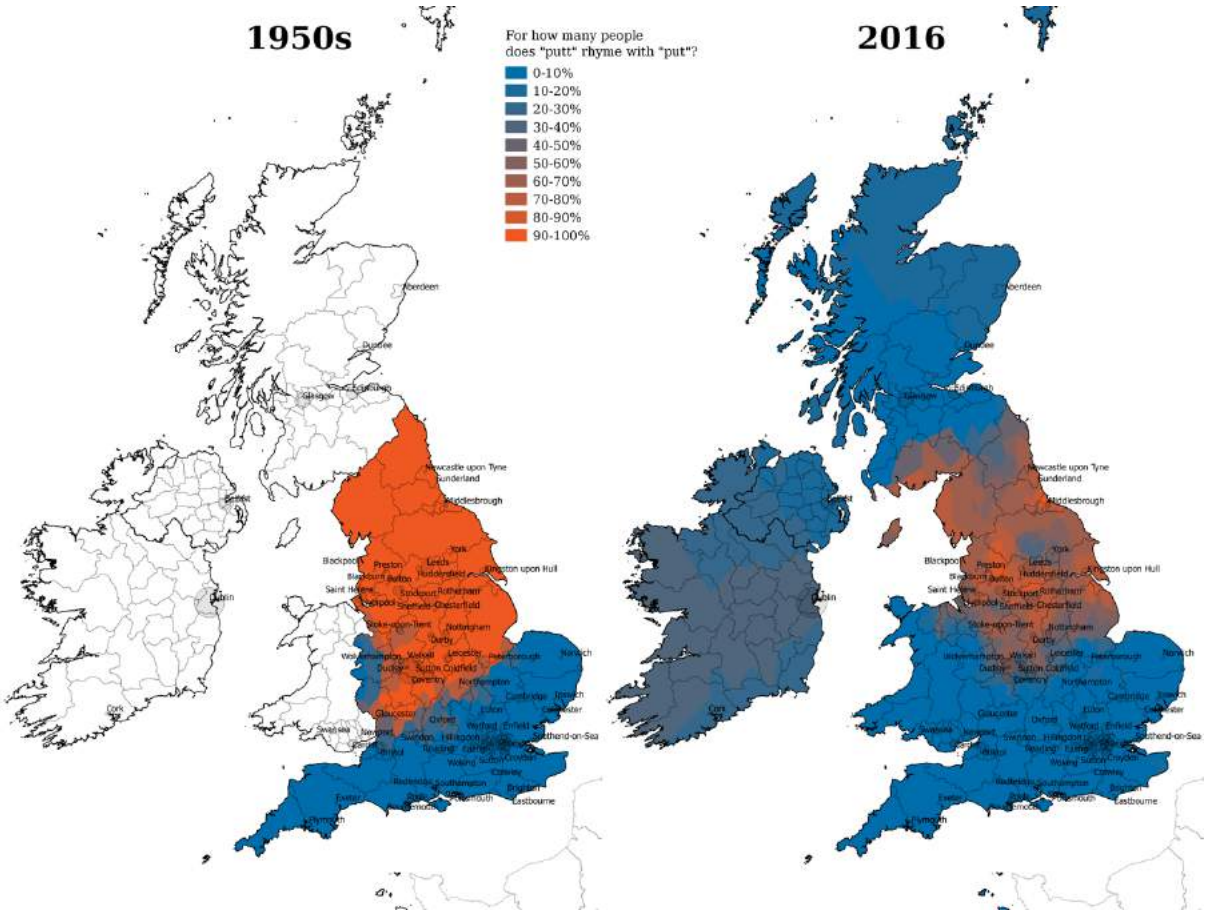

Figure 1: FOOT-STRUT split – SED (left) and EDA (right).

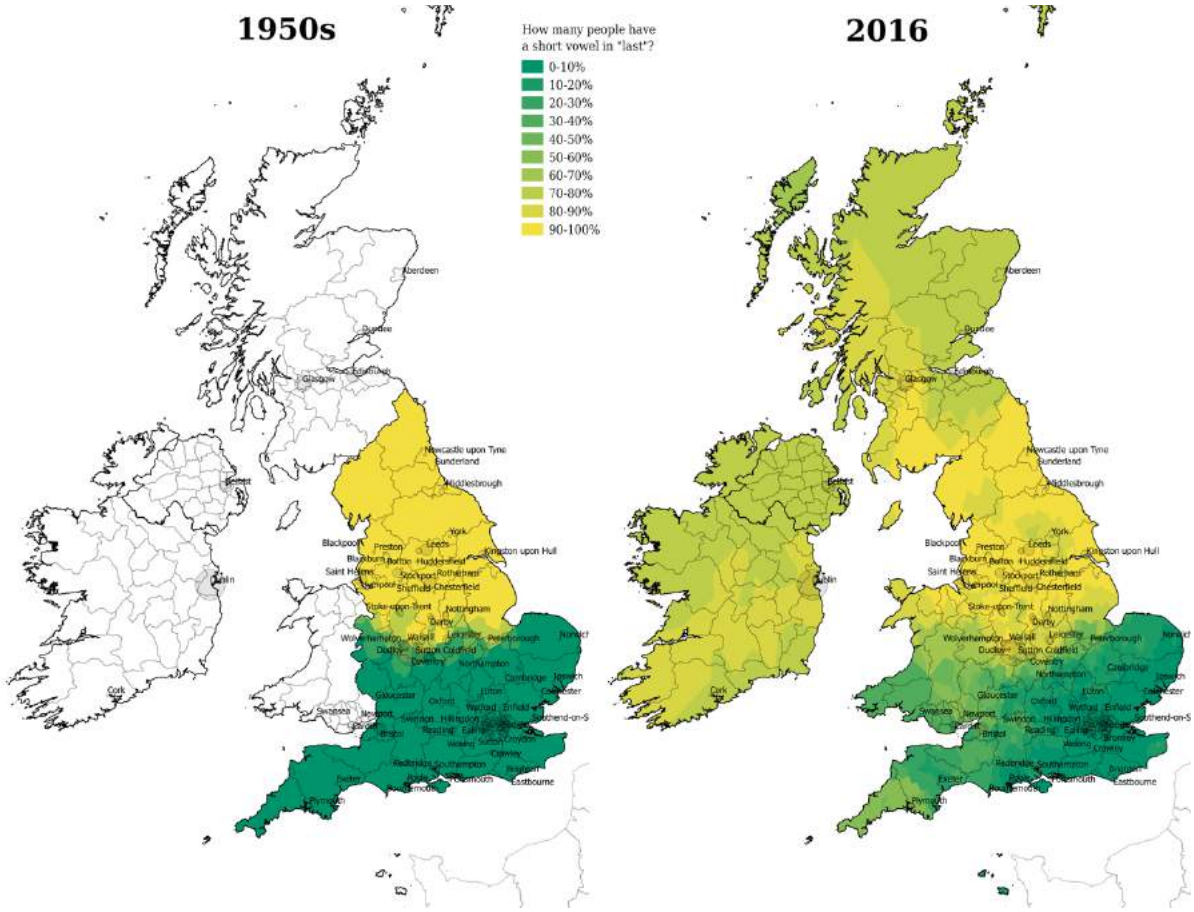

Figure 2: TRAP-BATH split – SED (left) and EDA (right).

Mouse tracking reveals differences in the timecourse of /r/ perception in two Glaswegian sociolects

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In Glasgow, speakers are stereotypically rhotic. However, recent sociophonetic research indicates a trend towards the loss of postvocalic /r/ in working class (WC) Glaswegian speech, leading to 'derhoticisation' (Stuart-Smith 2007), alongside a simultaneous strengthening in rhoticity in middle class (MC) Glaswegian (Lawson et al. 2011; Lennon 2015). Misperception occurs when listeners hear minimal pairs such as e.g. *hut/hurt*, when spoken by WC speakers who realise postvocalic /r/ as a pharyngealized variant, due to its perceptual (Lennon 2014) and acoustic (ibid. 2015) similarity with the preceding vowel in /CʌrC/. Lennon (2014) showed that this difficulty decreases as experience of the Glaswegian linguistic environment increases, and that short-term exposure to derhoticised /r/ promotes a change in perception for inexperienced listeners (ibid. 2016). While these studies show that perception of this feature varies between listener groups, this paper investigates the timecourse of perception, tracking listeners' perception as the word unfolds.

The mouse tracking paradigm (Spivey et al. 2005) tracks cursor trajectories as the participant moves the mouse towards their chosen response. Using MouseTracker (Freeman & Ambady 2010), participants clicked a 'Start' button at the bottom of the screen, triggering a stimulus, e.g. *hut* or *hurt*, to begin playing over headphones. While hearing the word they moved the mouse towards one of two buttons labelled e.g. 'hut' and 'hurt' at the top-left or top-right of the screen, clicking on what they thought they heard (Fig.1). Analysis of recorded trajectories (e.g. Fig.2) can reveal degree of attraction to the incorrect competitor as a word is heard.

51 participants from Glasgow and the surrounding area were tested on 192 stimuli (wordlist recordings of 2 native Glaswegian males: 1xMC, 1xWC) presented in three randomised blocks (experiment time = 30min.):

1. Block M: 12x MC target minimal pairs (e.g. *hut/hurt*) + 12x MC distractor pairs (e.g. *meek/make*)
2. Block W: 12x WC target minimal pairs (same words as block M) + 12x WC distractor pairs
3. Block R: All 48 pairs from blocks M&W, randomised together.

The presentation order of blocks M and W alternated by participant, with block R always completed last. Listeners identified *hut* and *hurt* stimuli accurately for WC stimuli (90.27%), and very accurately for MC stimuli (99.01%), matching the findings for Glaswegian listeners in both Lennon (2014) and (2016). In order to compare the mean trajectories for all factors of interest, two separate analysis techniques were employed: the spatial attraction measure Area Under the Curve (AUC): the on-screen area between each trajectory and an idealised straight line between start and endpoints (Fig.3) (Freeman & Ambady 2010), and Discrete Cosine Transforms (DCT) (Watson & Harrington 1999). The k0-k3 coefficients in DCTs describe properties of curves, and are a useful method of statistically modelling the properties of the trajectories.

Both AUC and DCT (of time vs. x-coordinates: mean trajectories reconstructed from DCT coeffs., Fig.4) were analysed in R using lme4 to build saturated mixed effects models: step() in lmerTest removed non-significant factors. The best AUC model contained the highly significant interaction Class(block):Coda (Class(block) = MC or WC stimulus & whether it appeared in block M, W or R; Coda = whether the word canonically has an /r/) ($Pr(>F)<1e-07$, $F=13.26$), such that MC *hurt* stimuli in block M have a smaller AUC than WC *hut* or *hurt* stimuli in any block, and WC *hurt* stimuli have a smaller AUC in block W than in block R (Fig.5). These results can be interpreted as there being less spatial attraction to the *hut* competitor when hearing MC *hurt* stimuli (in which /r/ is strongly rhotic) than when distinguishing WC *hut/hurt* pairs, and that the challenging nature of the randomised block R (2 speakers with different accents) makes it more difficult to distinguish between WC *hut* vs *hurt*, which are much more acoustically similar than the MC pairs.

The best models for each x-coordinate/time DCT coefficient also contained the highly significant interaction Class(block):Coda. Reported here is the model for k0 (k0 = mean x-coordinate of the trajectory: start: x=0, end: x=1 (Fig.3)) (Class(block):Coda, $Pr(>F)=1e-04$, $F=7.24$). This model shows similar patterns to the AUC model, but also significantly greater mean x-coordinate values for all MC stimuli in block M than in block R (Fig.6). This difference in mean x-coordinate suggests that it takes longer for participants to move horizontally across the screen towards the correct word when they hear the MC stimuli randomised with WC stimuli, than when they are presented on their own, even though the randomised block appeared afterwards.

These results appear to demonstrate the difficulty of perceptually switching between two speakers with different accents, even though the listeners were themselves native to the Glaswegian linguistic environment, and may reflect a similar processing asymmetry as that described by Mullennix & Pisoni (1990). Furthermore, this study is the first to apply DCT analysis to sociophonetic mouse tracking data.

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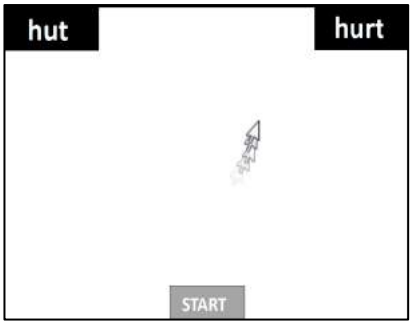

Fig.1: Computer screen display

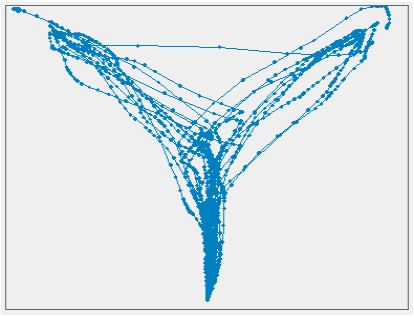

Fig.2: Multiple recorded trajectories

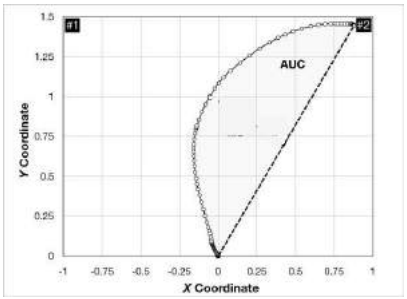

Fig.3: Area Under the Curve (Freeman & Ambady 2010: 229)

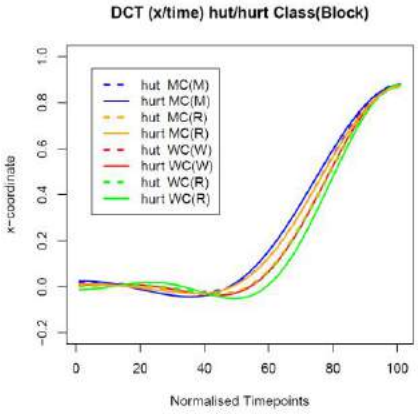

Fig.4: Mean x-coordinates of trajectories, reconstructed from DCT coefficients

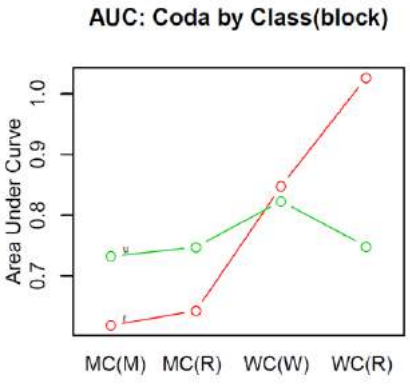

Fig.5: AUC Class(block):Coda interaction (hut=green; hurt=red)

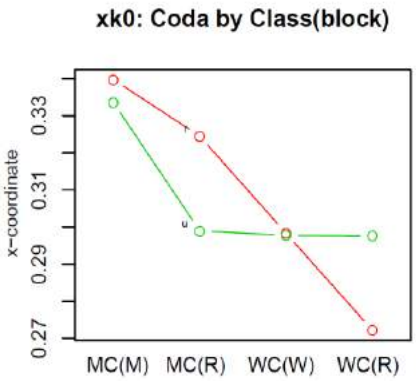

Fig.6: DCT k0 (mean x-coord.) Class(block):Coda interaction (hut=green; hurt=red)

On the Diachronic Change of Liquids in Onset Clusters and Codas across Tibetan Varieties: A Split Margin Analysis

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A potential relationship between onsets and codas is noted by Davis and Baertsch in their various works on the split margin approach to syllable structure (e.g. 2005, 2011) in which they argue for a close connection between the second member of an onset cluster and the coda. With respect to diachronic change, the split margin theory predicts that if a language with complex syllable margins starts to impose restrictions on its codas, parallel restrictions will also be imposed on onset clusters (Davis & Baertsch 2005, 2011). The present study examines the historical development of liquids as part of an onset cluster and as a singleton coda in three contemporary Tibetan varieties. Old Tibetan allows up to four consonants in the onset and up to two in the coda. This complexity has been simplified to varying degrees in descendants of the ancient language. In innovative varieties such as Central Tibetan (CT), the maximal syllable is essentially CV:(C). In conservative varieties such as Western Archaic Tibetan (WAT) and Eastern Amdo Tibetan (EAT), the maximal syllable could be as long as (C)CCCVC(C). The liquids, /l/ and /r/, in these modern Tibetan languages seem to have undergone similar historical changes in onset clusters and codas, which supports the split margin analysis of the syllable.

In the split margin approach, syllable margins are divided into two positions: M_1 and M_2 (See Figure 1). M_1 corresponds to a singleton onset or the first member of an onset cluster. M_2 corresponds to the second member of an onset cluster as well as the coda, which implies the two M_2 positions should pattern similarly. Liquids overall are avoided in coda position in modern varieties of Tibetan, innovative and conservative ones alike. In CT dialects, the prohibition of liquid codas is transparent, as they are almost always eliminated both word-finally and word-medially, which shows liquids are not tolerated in M_2. In WAT and EAT dialects, however, the avoidance of liquid codas is opaque: they are much more likely to be retained word-finally (more so for /r/ than /l/) but may either undergo deletion or resyllabification into the onset of the following syllable word-medially. Final consonants have been argued to be immune to segmental processes that apply to internal codas (Côté 2011). The fact that medial liquids are prone to leave coda position (i.e. resyllabify as onset) or delete altogether in conservative dialects further suggests a tendency to militate against them in M_2. This general restriction on liquids in the coda is mirrored in onset liquid clusters: the initial consonant in *Cl* clusters is usually deleted or incorporated into the lateral (e.g. fricated as [ɬ], preaspirated as [^{h}l] or [^{ɦ}l], etc.), allowing it to be analyzed as a single M_1 segment; the rhotic in *Cr* clusters combines with the preceding consonant in most cases to yield a retroflex affricate, which is also treated as a single segment occupying M_1. The behavior of liquids in onset clusters of greater complexity in the two conservative varieties provides even more support to the argument for liquids being avoided in M_2. In accounting for Polish initial clusters of up to four consonants, Gussmann (1992) analyzes complex syllable-initial sequences as two separate onsets each obeying the Sonority Sequencing Principle. The "double onset" representation can be understood in the split margin approach as two consecutive M_1 consonants each followed by an optional M_2 segment (See Figure 2). In *ClC, CrC(C)*, and *(C)CCr* initial clusters, the liquids tend to be deleted. Following the "double onset" analysis, both /l/ and /r/ in these longer sequences occupy M_2 position in one of the two onsets, and their disappearance mirrors their limited occurrence in the coda. Liquids occurring in M_1 – be they remnants of a cluster or the original singleton onset – generally remain. All in all, the parallel avoidance of liquids in all M_2 positions in Tibetan languages suggests a link between the diachronic development of codas and onset clusters as proposed in the split margin theory.

Figures

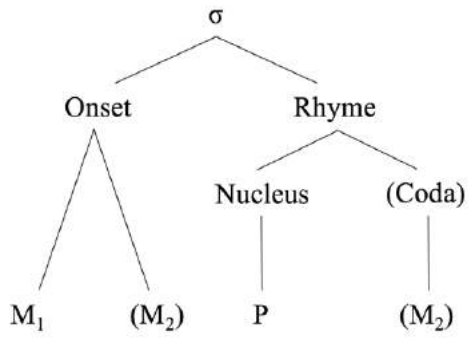

FIG 1. Syllable-internal structure under the split margin approach (M = Margin; P = Peak)

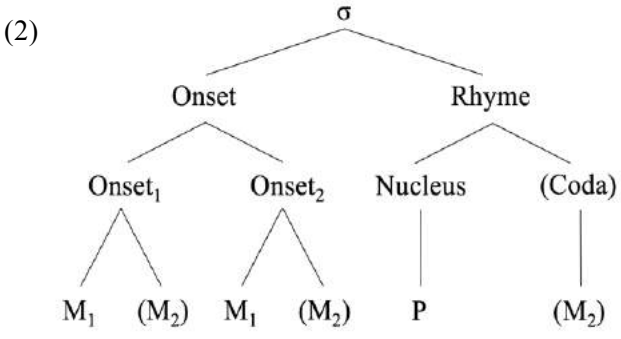

FIG 2. Expanded version of (1) under the "double onset" analysis

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In crowd(ing): convergence in the short vowel system of young RP speakers

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This paper presents an analysis of recent developments within the short front vowel system in Southern British English (SBE). Previous research on the SBE vowel system has demonstrated that there is a change in progress among the short front vowels, which are moving in an anti-clockwise direction. Typically described as a "drag chain" (Trudgill 2004), analysts have argued that the change was initiated by a backing (and lowering) of TRAP, followed by the subsequent lowering of DRESS and KIT and the potential upward rotation of STRUT (e.g., Wells 1982; Tollfree 1999; Torgersen & Kerswill 2004; Trudgill 2004). For some, this shift is a canonical example of a change-from-below, originating in the interior social classes and driven entirely by system-internal constraints (cf. Labov 1994). Others, in contrast, have argued for the importance of external factors, particularly as it spreads across the region (Torgersen & Kerswill 2004; Torgersen et al. 2006). Our analysis indicates that while the original motivation may indeed have been linguistic, subsequent developments require a social explanation.

Our data are drawn from the speech of cast members of two British "engineered reality" television programmes: Made in Chelsea (MiC) and The Only Way is Essex (TOWIE). This class-stratified sample – upper middle-class (UMC) Chelsea and working-class (WC) Essex – provides us with an ideal test site for examining how the vowel systems may pattern differently across the region (cf., e.g., Schilling-Estes 1998; Coupland 2007; Authors 2013). Vowels for analysis were taken from high-definition videos of the first two seasons of each programme. Segments with background noise, overlapping speech or anything else that could interfere with accurate readings of vowel formants were discarded. Formant measurements were automatically extracted using the University of Pennsylvania Forced Alignment and Vowel Extraction suite (Rosenfelder et al. 2011) with Lobanov normalisation. We extracted 7,727 vowels tokens (4,650 monophthongs, 3,077 diphthongs) across 30 speakers (balanced across speaker sex and programme).

Our results show a very different picture to that of the historical record for these dialects (e.g. Deterding 1997; Harrington et al. 2000). In particular, the extreme crowding of the lower back space for UMC speakers (see Figure 1) suggests an overall convergence in this community as opposed to a systemic re-structuring. This appears to indicate that while the older changes in these dialects may have shared an original impetus (e.g. lowered TRAP, as in Trudgill's drag chain), subsequent developments show that these systems have since diverged. Moreover, as the crowding in the UMC vowel space decreases perceptual distinctiveness, a social, as opposed to functional, explanation may provide a better account of the data (cf. stereotypical phrases like *gahp yah* for 'gap year' among hyper-privileged young speakers). In this paper we investigate this through an analysis of the DRESS vowel. Separate linear mixed-model regressions for F1, F2, and an overall "space value" (F2-F1; Ramsammy & Turton 2012) all agree that DRESS is significantly backer and lower among the UMC compared to WC speakers, despite a similar positioning of TRAP across the groups. There exists, moreover, a significant situational constraint on DRESS realisation in UMC speech, with certain speech activities eliciting more backed/lowered DRESS values than others, an effect that is absent in the WC data. Based on these results, we argue that recent developments in the UMC short front vowel system are not the result of a chain shift. Instead, we suggest that it is a convergent change (Torgersen et al. 2006) driven primarily by

extra-linguistic factors (Torgersen & Kerswill 2004), notably stance-taking and language style. More broadly, these results highlight the interplay of social and linguistic forces in the propagation of ongoing sound change.

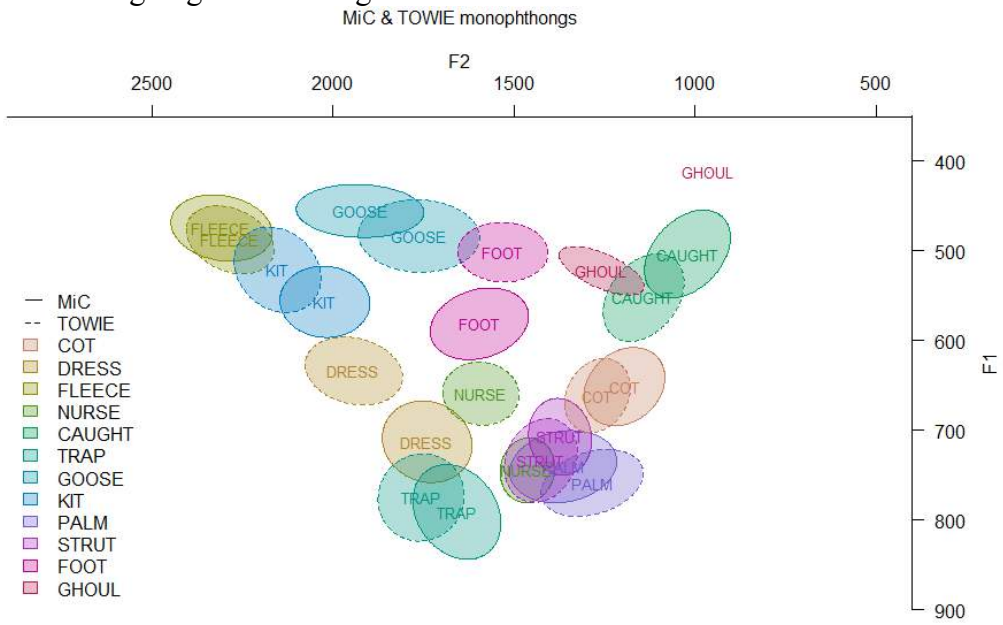

FIGURE 1. MONOPHTHONGS OF UMC (SOLID LINE) AND WC (DASHED LINE) SPEAKERS

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Sound change in Dalian Mandarin: vectors of change, sub-dialect levelling and the prestige of the local vernacular

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Language standardisation and rapid urbanisation are two key driving forces behind linguistic changes in today's metropolitan China (Guo 2004; Zhang and Xu 2008; Xu 2015). There is, however, a dearth of detailed study of how these global forces mesh with local identity, attitudes and linguistic use in Chinese cities (cf. Zhang 2014). Here we report a study of five phonological variables reportedly undergoing changes in Dalian Mandarin as a case study. Due to the trading post status of Dalian city, Dalian Mandarin was born in intense dialect contact between Northeastern and Northern Mandarin dialects (Liu 1986). Migration from Inland Northeastern China continues to this day, with the rise of standard Mandarin introducing a potential prestige variety and convergence target (Gao 2005). While existing studies indicate marked convergence towards the standard Mandarin norm, it is unclear whether participants in those studies were producing accented standard Mandarin or vernacular Dalian Mandarin.

We draw data from sociolinguistic interviews, passage and word list reading tasks from 39 Dalian Mandarin speakers, divided among three age groups (18-28, 36-48, 60-75) and balanced for sex. Crucially, all conversations took place in vernacular Dalian. Through a questionnaire and the interview, we gauge participants' attitudes towards and use of Dalian and standard Mandarin. The variables studied are (in Dalian Mandarin): 1. Dental instead of retroflex fricatives and affricates 2. absence of medial glide /u/ following alveolar consonants 3. monophthong /e/ for standard Mandarin /ai/ diphthong 4. schwa instead of /o/ following labials 5. use of /əŋ/ rhyme for /uŋ/. Incidence and acoustic patterns of variants were analysed with logistic or linear mixed-effects models, incorporating factors age, sex, occupation, and proxies for attitudes to Dalian Mandarin and the linguistic variables in question.

Three significant results emerge. While the reduction in local variants is generally associated with more formal registers and increasing in apparent time, neither the directionality nor the speed of change is monolithic (Stanford et al. 2014). Local variants for variable 4, for example, do not appear to correlate positively with age – the younger groups overwhelmingly use the local variants when vernacular Dalian is elicited, and little variation across registers is observed. By contrast, variable 1 and 2 shows clear retreat in apparent time, the latter interacting more strongly with style. Hence evidence for both convergence and divergence (Denning 1989).

Second- and third-generalisation speakers of Dalian and non-Dalian parentage exhibit a high degree of uniformity in their use frequency of local variants, in contrast to greater variability in the oldest age group. This levelling of sub-dialects within Dalian is consistent with 'the tyranny of the speech community', where the younger generation shows little attachment to the preferred variants of their primary caregivers (Labov 2012; 2016).

Globally, interviewees tend to characterise Dalian Mandarin as a positive, independent entity associated with being a "Dalianer". We show evidence of vectors of changes linked to the social salience and evaluation of variables. The link, however, is an indirect one: e.g. while the

lack of retroflex fricatives commands high social awareness, the loss of local variants appears to be slowed by the difficulty in acquiring a split (Payne 1976).

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Routinised mobility and vowel change at the individual and community levels in the North East of England

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The link between mobility and the spread of supralocal speech forms has long been recognised in sociolinguistics. Equally, the connection between immobility and the preservation of traditional, localised forms is a well-established cornerstone of work done in traditional dialectology. The extent to which people move around as part of their routine lives is clearly implicated, therefore, in the progression of sound changes. In this paper we explore the patterns of routinised mobility at the level of the individual speaker, and we assess the effects of individual mobility (or lack of it) on variation and change at the community and regional level.

The project we report on investigates phonological variation in the three major urban varieties of the North East of England - Newcastle, Sunderland and Middlesbrough. The *TUULS* project ('The use and utility of localised speech forms in determining identity: Forensic and sociophonetic perspectives'; ESRC ES/M010783/1) examines how variation at the individual level relates to generalised patterns of variation within the three accent groups as well as across the northeastern region as a whole.

We focus here on spectral and durational variability in word-final schwa in words of the lettER, commA, NEAR and CURE lexical sets (Wells 1982). In the North East of England, schwa is known to vary quite markedly even over short geographical distances (Beal *et al*. 2012; French *et al*. 2012). Our preliminary results indicate quality differences across the three varieties with Newcastle speakers producing open realisations, those in Middlesbrough generally using a non-localisable central vowel, and Sunderland speakers tending towards an intermediate or a fronted form. Results also demonstrate that in Newcastle, schwa may be up to 40% (+3dB) louder than the vowels of primary stressed syllables in the same words, and may be sustained for around twice the duration of stressed phonologically long vowels; these patterns are not observed to the same degree among speakers from the other two sites.

We examine age-correlated variation in read speech produced by male speakers of the three varieties to look for differences suggestive of change in progress. Evidence for convergent or divergent trends across the localities is assessed in combination with the individual speakers' self-reported mobility patterns within the region and beyond.

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The Phonetic Basis of Tone Change in Chinese Languages

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Introduction: Phonetic bias can condition phonologization and loss of phonological contrasts [1]-[4]. A well-known example of phonologization is new tones may originated from perturbation effects on intrinsic F0, while tone merger can be interpreted as a response to the phonetic similarity of two tonal categories. However, there is rarely any discussion on what phonetic basis can account for more complicated phonologization/merger conditioned by different tonal contexts. The current study seeks to provide a phonetic basis for such phonologization and merger in Chinese languages.

Historical change 1: Devoicing is more advanced in LEVEL than in other tonal contexts: In a devoicing and tone split stage, a voiced obstruent tended to become voiceless aspirated in the LEVEL tone category in a majority of Chinese languages (e.g. Cantonese, Mandarin and Chaozhou), and voiceless unaspirated in the NON-LEVEL tonal contexts. Along with the devoicing process, each tone category split into upper and lower registers. See Table 1.

Prediction 1: If the perturbation effect conditioned the more advanced devoicing in the LEVEL tonal context, and if residual effects are still visible in the modern languages, this predicts that *perturbation effect should be more robust and consistent in level than in non-level tonal contexts in all three languages*.

Historical change 2: The "unusual" tone merger occurred in RISING tone in some languages: In a later tone merger stage, some Chinese languages (e.g. Mandarin) underwent an "unusual" tone merger: the RISING tone with sonorant initials merged with the RISING tone initiated with the voiceless obstruent, instead of merging with the originally voiced obstruent. Other languages (e.g. Cantonese and Chaozhou) did not have such unusual merger. See Table 1.

Prediction 2: If the perturbation effect conditioned the unusual tone merger that only occured in Mandarin RISING, this predicts that *F0 perturbing behaviour in Mandarin rising tone should behave differently from that in Cantonese and Chaozhou rising tonal contexts*.

Experiment: A series of production experiments were conducted on Cantonese (n=8), Mandarin (n=6) and Chaozhou speakers (n=6). All stimuli followed a CV template. The tonal contexts were high-level and mid-rising tones. Initial consonants include voiceless aspirated stop, voiceless unaspirated stops, sonorants and voiced stops (Note: Chaozhou has voiced consonants that are evolved from nasals in Middle Chinese). F0 values following sonorants were the baseline for the consonantal effects. The mean scaled F0 values within the first 20ms of the vowel were analyzed.

Main findings: ANOVA and t-tests show that (1) though F0 after voiceless unaspirated is marginally higher than sonorant and voiceless aspirated in Cantonese mid-rising, the raising effect is more robust in high-level than in mid-rising context. The range of allowable articulation variation for high pitch is wider than mid or low pitch, which leads to more flexibility for perturbation effects to take place in high pitch; (2) F0 following voiceless aspirated obstruents is significantly lower than voiceless unaspirated and sonorants in Mandarin mid-rising tone, but not in Cantonese or Chaozhou mid-rising contexts. See Table 2 and Figure 1.

Implications: Both predictions 1 and 2 are supported by the results: (1) the robustness of raising effects in high-level contexts, rather than in non-high-level contexts, may imply the tendency of voiced consonants becoming voiceless aspirated in LEVEL, rather than non-LEVEL; (2) low F0 following voiceless aspirated obstruents is only found in Mandarin mid-rising context, which may have induced phonetic similarity between pitch after voiceless aspirated obstruents and after sonorants, and thus led to the tone merger between sonorant and voiceless obstruents.

Initial stage		Devoicing/Split Stage		Merger Stage					
Early Middle Chinese		Middle Chinese		Modern Cantonese		Modern Mandarin		Modern Chaozhou	
Tone	Onset	Tone	Onset	Tone	Onset	Tone	Onset	Tone	Onset
LEVEL	P, P^h	LEVEL upper	P^h	LEVEL upper	P^h	LEVEL upper	P^h	LEVEL upper	P^h
			P		P		P		P
	M	LEVEL lower	M	LEVEL lower	M	LEVEL lower	M	LEVEL lower	M
	B		P^h		P^h		P^h		P^h
RISING	P, P^h	RISING upper	P^h	**RISING upper**	P^h	**RISING upper**	P^h	**RISING upper**	P^h
			P		P		P		P
	M	RISING lower	M	RISING lower	M		M	RISING lower	M
	B		P		P	DEPART -ING	P		P

Table 1. *Devoicing, tone split and tone merger in Chinese languages*
P^h=voiceless aspirated obstruent, P=voiceless unaspirated obstruent, B=voiced obstruent, M=sonorant
Shaded and bolded parts highlight the relevant asymmetric devoicing and tone merger processes.

Tone / Languages	High-Level Tone	Mid-Rising Tone
Cantonese	F0(P) ≈ F0(P^h) > F0(M)	insignificant
Mandarin	F0(P) ≈ F0(P^h) > F0(M)	F0(P) ≈ F0(M) > F0(P^h)
Chaozhou	F0(P) ≈ F0(P^h) > F0(B) ≈ F0(M)	insignificant

Table 2. Summary of the results
P^h=voiceless aspirated obstruent, P=voiceless unaspirated obstruent, B=voiced obstruent, M=sonorant

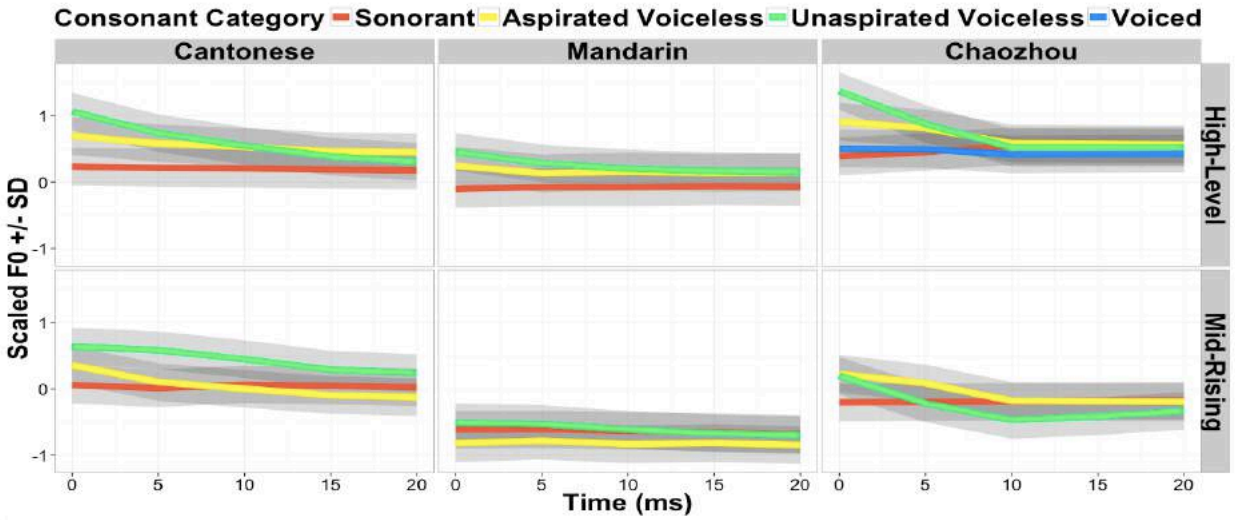

Figure 1. F0 trajectories in Cantonese, Mandarin and Chaozhou (20ms)

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Undoing the "lazy accent": Gender, age and language attitude in reversing Hong Kong Cantonese tone merger via phonetic imitation

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The rise of the so-called "lazy accent" in Hong Kong Cantonese (HKC) has been extensively documented in the past few decades (e.g. Chen, 1998; Mok, Zuo, & Wong, 2013; To, Mcleod, & Cheung, 2015). A significant feature of this accent is the tendency to merge multiple lexical tones. For example, the contrast between the mid-level tone (T3) and low-level tone (T6) is no longer strictly maintained by young HKC speakers (Mok et al. 2013). However, is the merger reversible? Can speakers reestablish the contrast via implicit imitation when exposed to unmerged speech? Despite the mounting research on phonetic imitation (Babel, 2012; Babel, McAuliffe, & Haber, 2013), few studies have looked at the imitation of tones, much less the imitation of tones that are undergoing a merger. This study investigates whether young HKC speakers can unmerge T3 and T6 in a phonetic imitation task and how the behavior is conditioned by features of the imitator (gender and language attitude), model talker (perceived age), and lexical items (lexical frequency).

32 native speakers of Hong Kong Cantonese (16F, 16M) aged between 18 and 25 joined the study. The production task consisted of four blocks: reading the stimuli in carrier sentences (B1); shadowing the model talker's production of the stimuli without visual presentation (B2); repeating B2 (B3); repeating B1 (B4). 24 monosyllabic Cantonese words balanced in tone (T3, T6) and usage frequency (high, low) were used as critical stimuli, randomly mixed with 24 fillers. The model talker was a male HKC native speaker in his 60s whose production clearly distinguished T3 and T6 (average tonal difference = 18Hz). The production task was followed by an Implicit Association Task (IAT; Greenwald, Nosek, & Banaji, 2003) and a language attitude questionnaire (Pantos & Perkins, 2012), in order to obtain the participants' implicit and explicit attitudes towards the lazy accent. The IAT made use of auditory stimuli of 5 disyllabic words recorded from a female HKC native speaker in both standard and lazy accents.

Results confirmed that it's common to merge T3/T6 among Hong Kong youngsters based on the pitch differences of T3/T6 tokens in B1. Production data were analyzed in mixed effects models. The general trend of unmerging the tone pair continued to increase from B1 to B4 during and after exposure, and B1 was significantly different from B3 ($t = 2.2$, $p = 0.029$) and B4 ($t = 2.81$, $p = 0.005$). Though both imitating, male and female subjects demonstrated different patterns (Figure 1). Subjects who believed that "lazy accent" is more prevalent among youngsters and expected the model talker to be older imitated more ($p = 0.05$). Lexical frequency was not significant in this process. From the IAT task, big individual difference on distinguishing the "lazy accent" and "standard pronunciation" was discovered. This was verified by the low correlation of IAT score with explicit attitude scores, even after excluding all trials of words that a subject claimed to have difficulty with ($r = 0.13$). In general, the more they use "lazy accent", the more positive they feel about it ($r = 0.45$); interestingly, a two-tailed

t-test showed no gender difference for explicit attitudes ($p = 0.77$, $t = -0.29$), but significant difference in actual usage ($p = 0.011$, $t = 2.69$).

The current study shows that ongoing tonal mergers can be unmerged through phonetic imitation, and this process interacts with multiple social factors. The study also provides insights on the applicable scope of IAT paradigm, as well as the complex picture of HKC sound change that deserves continued research attention.

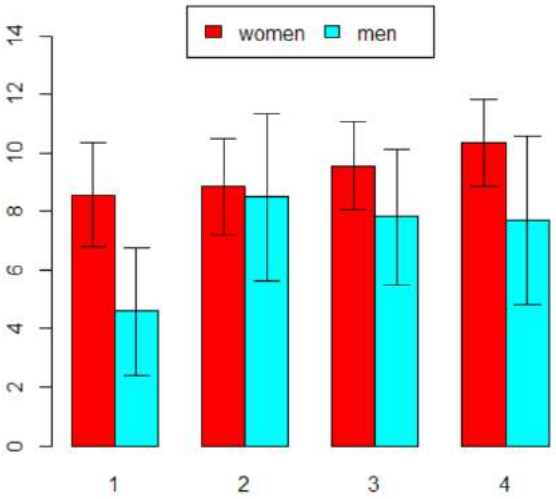

Figure 1: Overall change of tonal difference (T3-T6) through blocks by gender

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Parallel articulation as a mechanism of emergence of new phonemes

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Phonetic segmentation is a useful fiction layered over the speech continuum which provides linguists with an abstraction on which to base their generalizations about the sound system of a given language. However, there are phenomena whose nature is obscured rather than revealed by a theoretical perspective which essentially rests on a metaphor for speech as (alphabet-based) writing (speech as a string of phones). One such area is coarticulation and connected speech processes in the most general sense, the most extreme cases of which result in the integration of key perceptual cues from what would otherwise be separate segments into one. Various terms have been coined to describe these processes, including articulatory prosody (Kohler 1999) and parallel articulation (Machač and Zíková 2015). Intuitively, they often consist of a superimposition of a consonant's key distinctive feature or features like nasality or labiality on a vocalic or sonorant support, but they can also be less straightforward, as suggested by Kohler's (1999) example of glottalization in nasals as a surrogate / parallel articulation of alveolar stops in German.

The articulatory leeway in speech production is determined by a tendency to minimize the effort expended in pronouncing utterances while maximizing communicative success (Lindblom 1990). Another factor seems to be a propensity to preserve speaking rate (in terms of syllables per unit of time) across various speaking tempos (Engstrand and Krull, 2001). Thanks to frequency of occurrence effects and context disambiguation, a fair amount of variation is actually permissible, including the extreme (but not necessarily rare) cases cited above. Cases where the listener under- or over-accounts for the articulatory modifications induced by this room for variation have been identified by Ohala as loci of incipient sound change, in his classic talk "The listener as a source of sound change" (1981). The phonological aspects of the mechanism whereby certain kinds of sound change originate within the (learner) listener's perception were further elaborated by Hamann (2009).

The present paper proposes to examine both synchronic and diachronic evidence from various languages pointing towards the emergence of new phonemes via a process of parallel articulation of previously independent segments and subsequent re-analysis by hypocorrection on the listener's side into a new phonologically contrastive segment, whose perceptually salient traits can be traced back to an interaction between both of its ancestors. Obvious examples include the appearance of nasalized vowels in French or r-colored schwa in English (in both cases, some dialects still retain a two-phase pronunciation, like Provençal French or Scottish English). Less well-known ones can be found in Norwegian, where sequences of rhotic liquids and alveolar stops coalesced into retroflex stops (Hamann 2009), or informal spoken Czech, where evidence suggests that, contrary to expectations based on standard descriptions of the language, vowel nasality / palatalization and consonant labiality / velarization are used by listeners as a phonologically distinctive cue (Machač and Zíková 2015). Following Kohler and Niebuhr's "plea to base future speech perception research on a

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paradigm that makes the traditional segment–prosody divide more permeable, and moves away from the generally practiced phoneme orientation" (2011, 1), a case will be made for straddling the boundary between phonetics and phonology and paying attention to phonetic detail.

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The status of glides in Mandarin: A synchronic and diachronic study of syllable-internal processes

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By cross examination of both diachronic explanations, which may be gleaned from Old and Middle Chinese (OC, MC), and synchronic explanations, which may be gathered from consideration of Chinese dialects, I here attempt to explain the phonetic and phonological statuses, alongside geographic distributions, of glides across Mandarin varieties.

There are glides in Mandarin; however, their status continues to be disputed. Are they to be considered as independent segments which occur in medial position, that is, between the onset and rhyme (Cheng 2001, Wang 1997), as the first elements of diphthongs to be considered as part of the nucleus, or as secondary articulations on the onset (Duanmu 2000)? It may even be the case, as proposed by Li (2013), that [j] and [w] should be analysed differently from each other.

A study was conducted into the geographic distribution of glide insertion across China. There was reported a near categorical spread between the insertion of [j] in North China, and the complete absence of [j] insertion in South China, with gradience in Central China. [w] showed no significant relationship to geographical location, though it did show variability in how often it occurred with different speakers from different regions (see Graph 1). The phonological environments call for onsets to be voiceless and aspirated, which suggests that a possible motivation for this phenomenon stems from contrast maintenance between neighbouring sounds. For example, in a syllable with [u], though lacking [w], the high vowel is retained unaltered, so the need for contrast maintenance is gone, hence why we see F2 values return to the region of F2, for high vowels; normalizing within speaker.

Let us now turn to [j]. Stevens (1998: 518) suggests that when [j] precedes high vowels, it is more constricted, so contact bursts in the [j] spectrograms could be as a result of this more consonantal articulation. Essentially, the constriction becomes narrower, and this could enhance the contrast between two relatively similar sounds. Furthermore, contrasting aspiration with frication as maximally distinct phenomena (Fant 1960: 169) in the case of [j] after voiceless sounds, and assuming that only segments which have a noticeable contrast appear beside one another, may be another method of achieving discrimination.

A potential explanation for the north-south divide in the insertion of [j] could lie in the consideration of other processes which are documented as occurring within some Mandarin dialects. From early MC onwards, the development of what we now call the Chinese dialects is agreed to have occurred (Norman 1988; Pulleyblank 1973), with a major reduction seen in potential rhymes. This would have a knock on effect on the nucleus and coda. In particular, I focus on vowel lowering and nasal coda weakening. These syllable-internal processes may be determining whether glides are inserted, and this would also depend therefore on the speaker's native dialect. Nasal coda weakening or deletion, and simplification (indicated by 'rhyme mergers' (Li 1992)), is more common in Southern dialects such as Wu and Xiang, and this could be a barrier to glide insertion, which may rely on the velar nasal, rather than the alveolar nasal, due to regressive assimilation (feature spreading). In the north the process triggered is vowel lowering giving the high vowel a more schwa-like articulation, thus paving the way for glide insertion to help restore the [+high] feature of the syllable.

(1) Geographic Distribution of [j] insertion: Groups of Speakers

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Abstractions or exemplars? How contextual information filters the acoustic signal and guides sound change.

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Early models of exemplar theory (Johnson 1997) proposed that the speech signal remains unmodified before word recognition, such that listeners store all details of acoustic information in memory in memory traces known as exemplars. This model suggests that abstract representations need not be activated in word recognition. Later models (Pierrehumbert 2006 , Goldinger 2007) argue for the existence of both abstract representations *and* exemplars, and as Goldinger (2007) states, "[E]ach stored exemplar is actually a product of perceptual input combined with prior knowledge…" suggesting both are activated in some way in perceiving speech. Meanwhile, research in psycholinguistics has established the effect of context on speech perception, in studies of understanding words in fluent speech (Pollack & Pickett 1963), the phonemic restoration effect (Warren 1970, Samuel 1981, 1987), fluent restoration (Marslen-Wilsen & Welsh 1978), and error detection (Cole, Jakimik & Cooper 1978), in which speakers use context for aiding word recognition, to the extent that phonetic details of words may pass unnoticed. The current study investigates how the predictability of words in context modulates attention to phonetic detail. The results of a first experiment suggest stronger activation of abstracted forms when listening to predictable speech, and a greater attention to and processing of phonetic details when listening to unpredictable speech. A second experiment, using the phonetic accommodation paradigm, showed that perception of these details affects production, suggesting relevance in the shaping of one's exemplars and the spread of sound changes.

The first experiment in this study isolated the role of the listener and the effect of predictability on speech perception. Subjects were asked to listen to both predictable and unpredictable words in a sentence context, followed by hearing them repeated in isolation. Subjects then judged whether the repetition of the word was exactly identical to its first presentation in sentence context. The repeated word may have been identical or was manipulated to have longer VOT in their onset /k/ and higher pitch in the first syllable. Overall, a mixed-effects logistic regression model showed that subjects made significantly more errors ($p = 0.012$) when hearing and comparing predictable words in context and in isolation, as opposed to when hearing unpredictable words. This suggests the subjects retained more phonetic details in exemplars of unpredictable words, while they may have been more influenced by their own abstract representations of predictable words.

The second experiment used the phonetic accommodation paradigm (Goldinger 1998) to study the role of the listener turned speaker (thus the effect of perception on production). Subjects were asked to repeat sentences containing the same target predictable and unpredictable words of the first experiment, which were presented with lengthened VOT of initial /k/ and higher first syllable pitch. Despite being given no instruction to imitate, subjects showed closer imitation of the model when repeating unpredictable words, aligning with the results from the first experiment. In a second version of the experiment subjects were explicitly told to imitate the model, in which case differences in imitation of predictable and unpredictable words were not significant, although subjects did become significantly more like the model over the course of the experiment for unpredictable words only.

The results of the experiments suggest that listeners may more heavily activate their own abstract representations of words when listening to predictable speech, but store more phonetic details in exemplars of unpredictable speech. The second experiment showed that this perceptual duality affected production, and is thus relevant in shaping one's exemplar cloud and potentially in the spread of sound change. This may be particularly relevant in explaining the profoundly different sound changes that affect globally more predictable word and morpheme classes, such as function words, as opposed to more unpredictable content words.

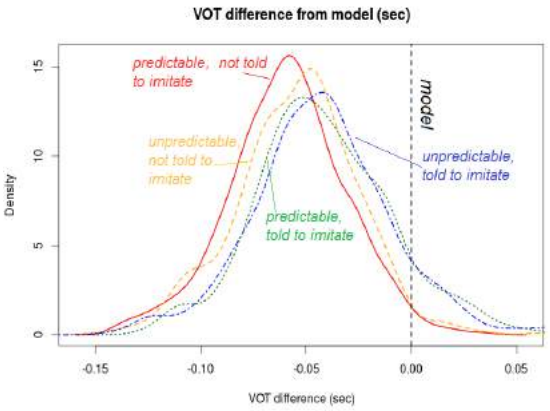

Figure 1: Difference from model's VOT by condition: In the imitation experiment, subjects' VOT was closer to that of the model when repeating unpredictable words, in both instructional conditions

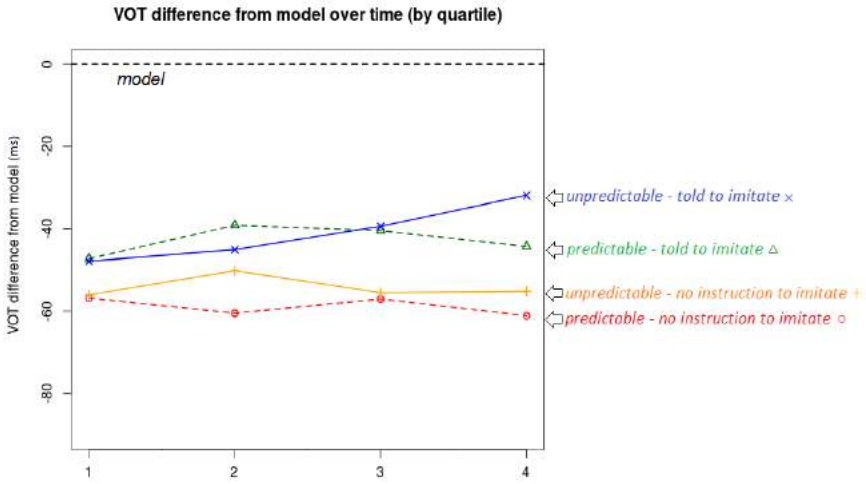

Figure 2: Difference from the model's VOT over time: When told to imitate, subjects' VOT became closer to the model (increased) but only for unpredictable words.

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Catching a distinction before it disappears

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Cantonese as a tone language specifies lexical tones for each syllable. However, through the process of 'tone change', a syllable with a non-high rising tone may change to a high-rising tone. Such change is only applicable to a limited set of syllables and in a selective set of morphological contexts.

Early studies describing the 'tone change' have made conflicting claims regarding the distinction between the derived (DR) and the lexical (LR) high rising tones. Some believed that DR has a lower onset than LR, but the two are comparable at offsets [1, 2]. Some, however, considered DR similar to LR and sometimes have higher offset than LR [3]. Later studies claimed that DR and LR are similar or have merged completely [4, 5]. These studies all gave impressionistic descriptions; some provided illustrative pitch contours of DR and LR but did not conduct detailed acoustic analysis.

A more recent study that examined phonetic data holds the view that DR and LR are distinct previously and that the two are in the final stage of merging [6]. It was reported that DR and LR are consistently distinguished in production with DR having a higher pitch than LR; but the two are indistinguishable in perception. Given such asymmetry between production and perception, [6] argued that DR and LR are in a near-merge state. Nevertheless, there were only five speakers in the study with much variation. Revisiting the issue almost ten years later, [7] found that the distinction has been neutralized among young speakers.

While it seems that the merge has completed in the young, it remains unclear whether it is also the case in older generations. The current study fills this gap by examining production of thirty-four (near) minimal pairs of DR and LR by 17 senior speakers (10 females, 7 males, aged 64-79). We tracked F0 contours on the rhyme at eleven equi-distant points using ProsodyPro [8] in Praat [9]. A hierarchical cluster analysis (with the 'average' method) is conducted in R [10] to group speakers based on their averaged pitch difference (measured in z-score) between DR and LR at trough and peak positions. Results shown in Fig. 1 and Fig.2 indicate that there are three types of speakers: those who have higher pitch for DR than LR (cluster 3 = 2 speakers), those who demonstrate the opposite pattern (cluster 2 = 4 speakers), and those who hardly distinguish the two (cluster 1 = 10 speakers). Fig. 3 shows pitch contours of DR and LR by speaker group in SSANOVA [11] which is a statistic method for comparing curves. All non-overlapping parts are significantly different. As can be seen, for most speakers (cluster 1), DR on average is slightly higher than LR but the distinction is insignificant. However, for the two male speakers in cluster3 (upper right corner in Fig. 2), distinction between DR and LR is large and significant. We interpret this as clues for DR having a higher pitch than LR. The two rising tones are approaching complete neutralization among senior speakers. The finding that the speakers who still maintain the distinction are males is consistent with the general pattern of females taking a lead in sound change, e.g. [12]. As for the speakers in cluster 2 (lower left corner in Fig. 2), since the pattern of DR having a lower peak than LR has never been documented before, we hypothesize that it might be a case of over-compensation [e.g. 13]: lowering the pitch of DR to match LR but over did it. Alternative explanations are possible. We are collecting data from more senior speakers to gain further insights.

This study fills the gap in previous research on Cantonese tone change by documenting the phenomenon in senior speakers. We show that in contrast to complete

neutralization in young speakers, the distinction between the derived and lexical high rising tones is still maintained in a few senior speakers. Together the findings point to a merging process fast approaching completion.

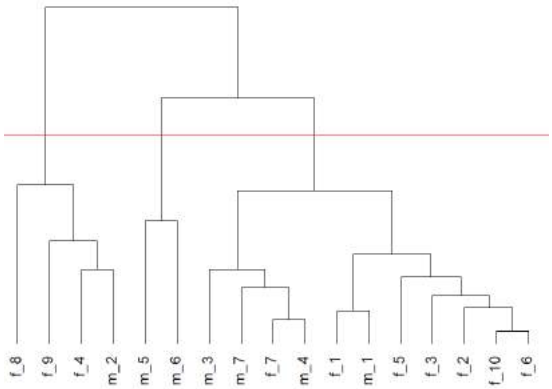

Fig. 1 Dendrogram of hierarchical cluster analysis based on speakers' pitch differences between DR and LR at trough and peak positions.

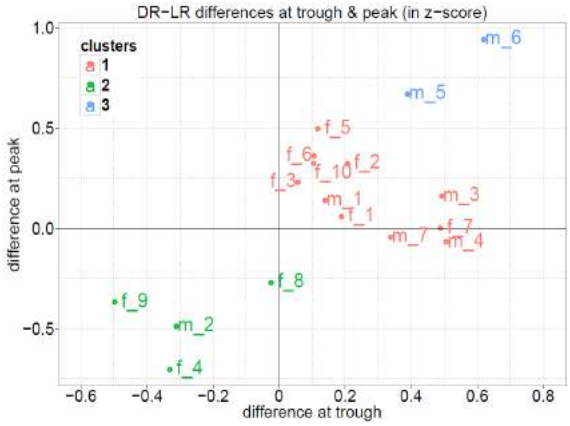

Fig. 2 Speakers' pitch differences between DR and LR at trough and peak positions. Colors correspond to results of hierarchical cluster analysis.

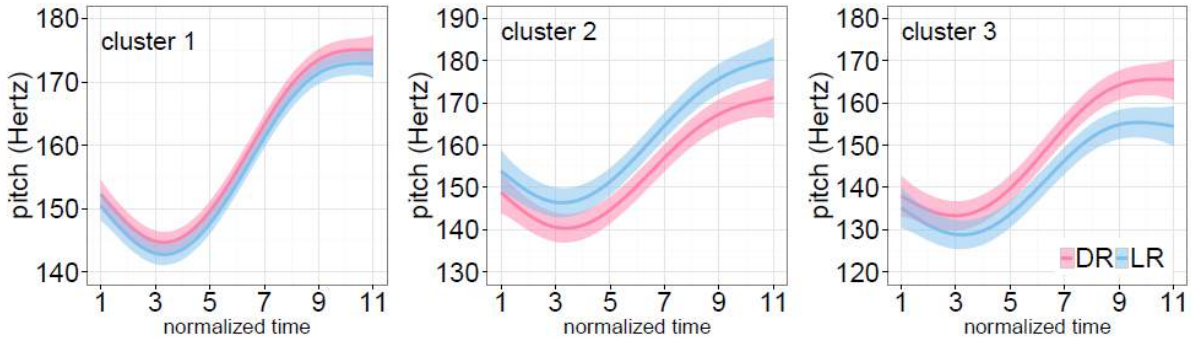

Fig. 3 SSANOVA of pitch contours on DR and LR of speaker groups

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Representational Considerations in Models of Sound Change

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One view of phoneme split takes it to be the result of divergent phonetic variants (e.g., Janda and Joseph 2003). Closely tied to this view is the hypothesis of iterativity: socially motivated phonetic exaggeration accumulating over successive generations (e.g., Labov 1972, Guy 1980), or progressive reduction of frequent words over time (Phillips 1984, Bybee 2002). Iterativity is often assumed to be an inherent property of exemplar models. In a typical scenario production starts with the selection of a token from the desired category. The token is then reduced, lenited, or otherwise altered in some way, resulting in a new phonetic token. The new token is added back to the cloud of stored tokens, and the process starts over again (see Pierrehumbert (2001)). Via this production-perception loop words can be reduced two or more times with respect to the originating token. As more frequent words are more often produced, the chances of multiply reduced tokens are higher. However, contrary to expectation, the mechanism described does not consistently result in shorter word lengths for high-frequency vs. low-frequency words. If frequency of occurrence is expressed in number of tokens, and sampling for production is random, then producing a *less* reduced token is also more likely in high, than low, frequency categories. And regardless of whether tokens decay, or are replaced, the low-frequency category will eventually 'catch up' with the higher-frequency category, and all words will achieve some optimal length. In fact, the production side of this model makes even more problematic predictions. If phoneme-level tokens are selected at random from a phonetically detailed exemplar cloud then egregious mismatch is possible; e.g., an [æ] originally followed by an [m] being selected for a pre-[b] context. It is the same at the word level: a word token originally produced in a frequent collocation, selected for a low-frequency context, etc. Indexing exemplar clouds with all the necessary contextual information, however, results in an explosion of categories, and a depletion of category members. In the limit, each category would contain a single member.

Developing a model for the interaction of synchronic variation and diachronic change requires resolving these and other representational issues, some of which only surface when the entire trajectory of change is considered. Thus, while existing models can capture category shift and merger (Pierrehumbert 2001), or contrast stability and dispersion (Garrett and Johnson 2013, Wedel 2004), there are few that can capture both[1]. The model of Sóskuthy (2013) can generate phoneme split, no-change, and no-split with phonetic shift, as the result of vowel lengthening before voiced obstruents. However, these outcomes require a representational structure in which vowel categories contain at least two sub-categories: pre voiced-obstruent, and pre voiceless-obstruent. Crucially, these subcategories are semi-permeable, and greater frequency of occurrence can cause one sub-category to subsume the other. This scenario raises another unresolved question in exemplar modeling: the interaction between higher and lower level categories. Most models work exclusively at one level, and assume the others[2]. But the process by which the necessary categories at the sub-word level are generated from the word level (or vice versa) is non-trivial, and may not be consistent with model assumptions. A category as abstract as "vowels occurring in environments followed by a voiced obstruent" requires a massive amount of generalization over words with different syllable structures, over obstruents at different places of articulation, etc. And if speakers create categories such as this, then they can be expected to create categories such as "vowels before coronals", etc. It is not at all clear that existing models will be able to 'scale up' adequately under this added complexity.

This work gives a formal account of the representational commitments and assumptions of a range of models, and an assessment of their self-consistency. The claim is that the resolution of outstanding problems lies in determining the division between representations and processes. I argue, on the one hand, that phonetic effects such as "vowel lengthening", or "vowel nasalization" are not processes themselves, but reside at the representational

[1] Kirby and Sonderegger (2013) is taken to be a model of diffusion, not actuation.

[2] Wedel (2007) produces a range of outcomes with a feedback loop between "word" and "phoneme" representations; but the underlying categories for the segments in each word are given, and change is represented as the flipping of a binary feature value, thus assuming prior categorical distinctions.

level. On the other hand, speaking rate must be able to apply after exemplar selection to compress or expand tokens as necessary to match speed of production. I consider prosodic effects, such as phrase-final lengthening to be necessarily processual as well. The ramifications of these representational choices are discussed with respect to the necessary constraints on a model deriving categorical sound change from existing synchronic variation.

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Black South African English: the changing quality of KIT and NURSE

The pronunciation of the KIT and NURSE vowels is a salient marker of Black South African English (BSAE) and often reported as being merged with FLEECE and DRESS respectively (e.g. Van Rooy & Van Huyssteen 2000; De Klerk & Gough 2002; Van Rooy 2004). This paper investigates the degree of these mergers with a sample of 44 BSAE speakers performing three speech styles (wordlist, reading passage and interview). The Lobanov-normalised vowel formant values were extracted and subjected to descriptive and analytical statistics using linguistic (L1 language family, context, speech style) and social (gender, age group) factors. Vowel distinction was measured by means of Pillai score (cf. Hay et al. 2006; Nycz & Hall-Lew 2014) and Bhattacharyya coefficient (cf. Johnson 2015).

Both methods show the same trend suggesting that of the linguistic variables, speech style is the most decisive, showing that most participants differentiate between a formal (wordlist) and a casual (interview) speech style. Of the social variables, age has the biggest influence on vowel realisation with the young age group exhibiting the greatest variation. Moreover, some young participants show a centralised KIT vowel or a lowered, DRESS-like variant, which are characteristics of White South African English (WSAE). This could hint at an incipient "KIT split", the context-dependent production of KIT allophones (Wells 1982; Lass 1991; Bekker 2014), as a possible adoption from WSAE.

The divergence of the youngest participants from commonly reported features of BSAE suggests an ongoing language change. The reasons for that may be manifold, but all occur against the background of the changes in the political system in the country. For example, early exposure to English (e.g. in multi-racial, English-speaking crèches) may account for this development as well as improved educational conditions at schools. It is equally conceivable that young adult BSAE speakers consciously approximate features of WSAE as the prestigious linguistic norm, a suggestion that is backed by studies of Da Silva (2007) and Mesthrie (2010). However, not all young participants show this outcome, the possible reasons of which will also be discussed.

Keywords: socio-phonetics, Black South African English, vowel formants, pronunciation

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The onset voicing effect during sound change: evidence from Dutch labiodental fricatives

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In a wide variety of languages, it has been reported that vowel F0 at the onset tends to be lower after voiced than after voiceless consonants (e.g., House & Fairbanks, 1953; Hombert et al., 1979). This phenomenon has been called the *onset voicing effect* (OVE) by Kirby & Ladd (2015).

Previous studies have established that Dutch initial fricatives are involved in a sound change in progress: voiced initial fricatives are devoicing, merging with their voiceless counterparts, and the devoicing is spreading across regions (e.g., Kissine et al., 2003; Pinget, 2015). This paper investigates the presence and the evolution of the OVE during this sound change:

- The first aim is to examine the evolution of the OVE by comparing regions. The maintenance of the OVE in the case of devoicing would provide evidence for *incipient tonogenesis* in Dutch (involving a shift in phonetic cues to mark voicing), whereas its disappearance would indicate that initial labiodental fricatives develop as a *full merger*.
- The second aim is to investigate the relationship between voicing in fricatives and vowel F0 in order to discuss the possible source of the OVE. Two hypotheses have been proposed in the literature: 1) voicing and F0 stand in a trading relationship in order to enhance the phonological contrast (Repp, 1982; Shultz et al., 2012), or 2) voicing and F0 go hand in hand because of the physiological constraints underlying the OVE (downward movement of the larynx during voicing) (Westbury, 1983; Kirby & Ladd, 2015).

Five regions within the Dutch speaking area were chosen to represent the different stages of sound change, ranging from West-Flanders (with incipient devoicing) to Groningen (with full devoicing). Twenty speakers (10 males and 10 females) were recorded in each region, reading words beginning with /f/ and /v/ in carrier sentences. Following segmentation, voicing was measured as the proportion of the fricative segments produced as voiced, and F0 was extracted at 11 equidistant time points over the vowels.

Results show clear regional differences in the OVE corresponding to the regional spread of the sound change. Figure 1 shows the time course of F0 realizations: the OVE is clearly present in the regions West-Flanders, Flemish-Brabant and Limburg where devoicing is weak. In the regions with strong devoicing (South-Holland and Groningen), both voiced and voiceless fricatives show high F0 at onset and falling F0 contours. The sound change seems thus to trigger a reduction of the OVE, but not (yet) its full disappearance. We argue that these results are in line with the full merger hypothesis.

Figure 2 shows the relationship between voicing and F0 at the onset of the vowel. A mixed-model linear regression fitted to all tokens shows that the less voicing in voiced fricatives, the higher the F0 at onset. No relationship was found in voiceless fricatives. Moreover, the analysis at the individual level confirms this finding: the more an individual devoices, the higher the F0 at onset. In conclusion, the results from the regional, individual and token levels seem to confirm the physiological explanation for the OVE.

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Figure 1: Time course of F0 realizations per phonological forms (/v/ and /f/), split up by region. Error bars show 95% confidence interval; x-axis shows normalized vowel duration; y-axis shows F0 normalized.

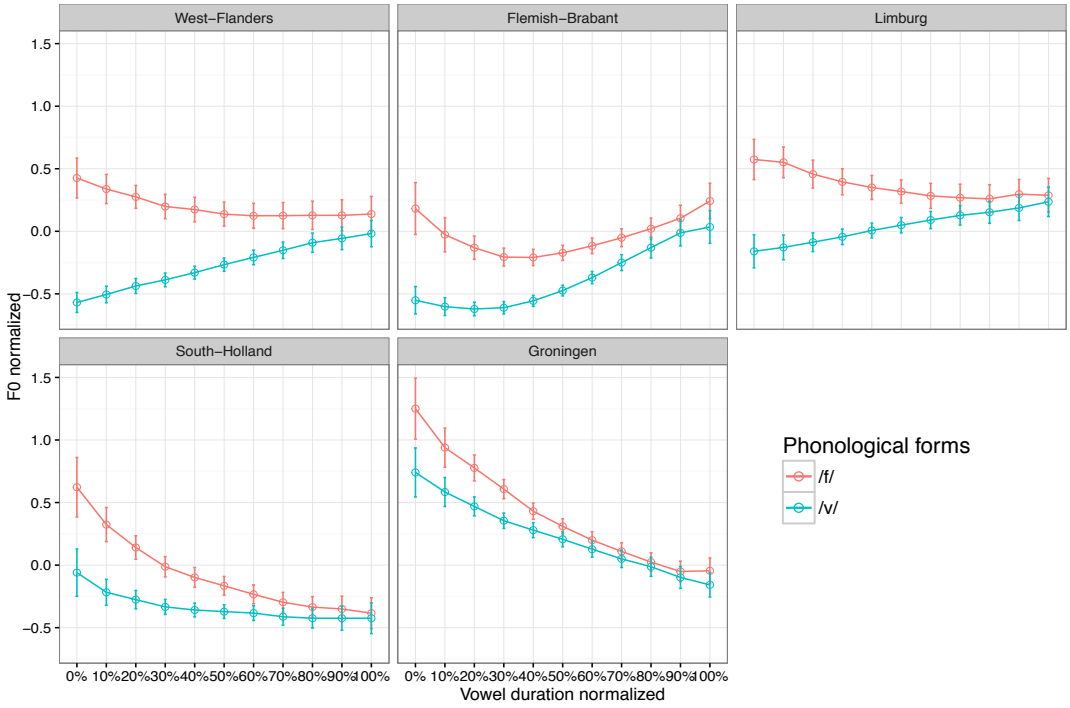
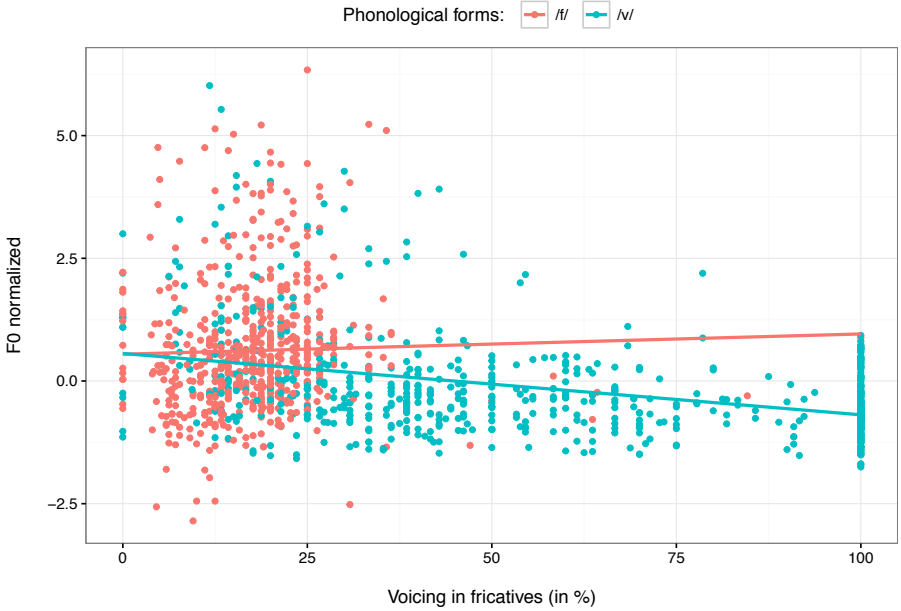


Figure 2: Voicing-F0 relationship at vowel onset, split up by phonological form (/v/ and /f/). Lines indicate linear trends modeled per phonological form.



Listeners misattribute coarticulation on lax vowels to speaker height

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Listeners are generally adept at compensating for coarticulation by attributing the resulting variation to its proper source (Mann, 1980). In some cases, listeners fail to compensate, creating the seeds for potential phonological reanalysis (Ohala, 1993). Pinpointing the conditioning environments for such mis-attribution remains a major challenge for our understanding of sound change. Several researchers have highlighted differences among individuals, and shown that certain types of listeners have greater tendencies toward mis-attribution than others (Beddor, 2009; Yu, 2010). In the current study, we highlight differences between individual vowels, and show that certain types of vowels are more likely to be mis-attributed than others. Specifically, we show that listeners are more likely to mis-attribute coarticulatory variation on lax vowels, but not tense vowels, to differences in speaker height.

Our starting point comes from production studies of American English which suggest that tense and lax vowels receive different coarticulatory influences from subsequent codas. In a study of CVC words, Pycha (2016) showed that the *temporal extent* of coarticulatory formant lowering from coda consonants differed for tense versus lax vowels. Before both alveolar and bilabial codas, formants for tense [i] began to lower only near vowel offset, but formants for lax [ɪ] began to lower much earlier – closer to vowel onset–as schematized in Figure 1. In other words, the temporal extent of coarticulation, as a percentage of total vowel duration, is significantly greater on [ɪ] than on [i], well beyond what the inherent durational differences between these two vowels would lead us to expect.

This finding has implications for how listeners might interpret differences in coarticulatory variation when compensation is not complete: specifically, lax vowels may sound as if they are spoken by taller speakers than tense vowels. Because a) such a large percentage of lax V duration is occupied by lowered formants, b) lower formants are typical of longer vocal tracts (Lieberman & Blumstein, 1988), c) longer vocal tracts correlate with taller people (Fitch & Giedd, 1999), and d) listeners can and do use formants to estimate speaker height (Smith, Patterson, Turner, Kawahara, & Irino, 2005), we reasoned that listeners may mis-attribute a coarticulatory pattern that was originally triggered by a coda C to a very different source – namely, to increased speaker height.

We tested this hypothesis by presenting CiC and CɪC tokens to listeners (n=23) and asking them, for each word, to estimate the height of the speaker. Twelve females produced multiple repetitions of nonsense words [git, gid, gip, gib] and [gɪt, gɪd, gɪp, gɪb]. From these, we selected tokens such that mean values for temporal extent of coarticulation (duration of formant transition/total V duration) differed across lax (77%) versus tense (19%) conditions. Importantly, the spectral extent of coarticulation (maximum F2/offset F2) was matched across these conditions, such that the crucial difference between tense and lax tokens lay in the temporal extent of coarticulation, not its magnitude. Participants heard 96 target words (four tense and four lax V words from each speaker), plus 72 fillers. The crucial question was whether participants would give greater height estimates for [gɪp] words compared to [gip] words.

The height responses were assessed using a linear mixed effects model with fixed predictors of vowel type (tense vs. lax) and mean word f0 (logged), as well as by-participant random intercepts and by-participant random slopes for vowel. Results, displayed in Figure 2, showed a significant main effect of vowel type on reported speaker height: listeners were reliably more likely to report that the same speakers were slightly taller when they produced words with the lax vowels (164.7 cm) compared to when they produced words with tense vowels (163.9 cm) ($F=4.5$, $p<.05$).

These results, while limited to [i] and [ɪ], suggest that listeners do not fully attribute coarticulatory variation on lax vowels to its proper source (namely, the coda C), but rather mis-attribute it to speaker height. The implication for sound change is that listeners may be more likely to mis-interpret the phonological characteristics of a CVC word when V is lax. Thus, lax vowels appear

to provide a specific conditioning environment for mis-attribution and, compared to tense vowels, they may be more susceptible to sound change over time.

Figure 1. Schematic F2 trajectories for tense versus lax vowels before codas (either alveolar or labial).

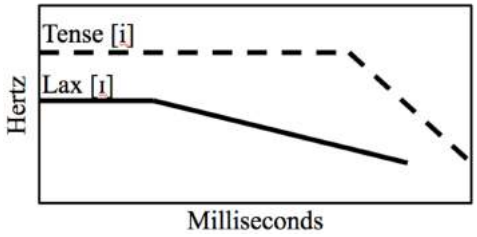
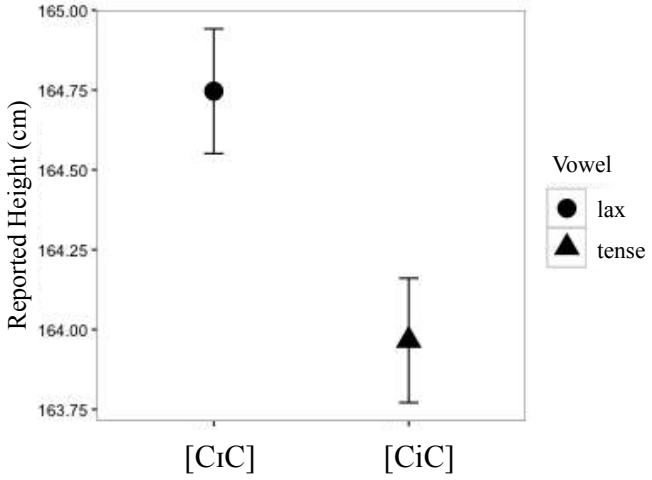


Figure 2. Mean reported speaker heights for words with tense versus lax vowels. Error bars depict standard error of the mean.



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Lenition and Tonogenesis in Sylheti

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This paper explores the tonogenesis triggered by lenition in Sylheti, which is disputably regarded asa dialect of Bangla, a language with a major population of about 12 million. The language undergoes spirantization for the entire voiceless series of obstruents and a loss of breathy voice contrast all over the voiceless and voiced obstruents. The loss of sound features used for contrast in the language is replaced by the usage of F0 cues for contrast. The loss of breathy voice contrast [+spread glottis] resulted in a high tone among the voiced obstruents (Gope & Mahanta 2014).

The present study is based on the tonogenesis triggered by lenition largely on the voiceless series of obstruents, which involves deaspiration and spirantization and looks into the spirantization and deaffrication of voiceless stops and affricates. This abstract reports data collected and analyzed from 4 speakers from a corpus of about 120 words with multiple iterations using a Tascam DR MKII 100 recorder. The results show that the loss of contrastive [+spread glottis] feature of the entire series of voiceless obstruents results in a low tone on the following vowel. This loss of [+spread glottis] feature forms minimal pairs with its unaspirated counterpart, which on the other hand, imparts a high tone on the following vowel (Fig 1 and 2).In the previous study (Gope & Mahanta 2014) it was concluded that the voiceless series received the opposing tone after the loss of aspiration in the voiced series resulted in a low tone. We argue here that it is the [-voice, +spread glottis] feature which was first reinterpreted as a lexical high tone in the language. The subsequent assignment of low tone [+voice +spread glottis] was a consequence of this initial change in lexical tone assignment and tonogenesis. A further lenition that the language undergoes is the deletion of /h/ and debuccalization to /h/ from /ʃ/. The h-deletion leads to a tonal contrastive pair with vowel initial words contrasted only by F0 value variation. The h-deletion perturbs a high on its following vowel whereas the vowel following debuccalised /h/and the vowel initial words are found to receive a low tone (Fig 3 and 4).

The loss of occlusion in Sylheti for most of the consonants is compensated by tone assignment. This classifies the language with a very few Indo-Aryan languages which are reported to be tonal

e.g. Punjabi and certain Gur Languages. This paper will explore the tonogenesis and the tonemic inventory resulted by these sound changes in detail.

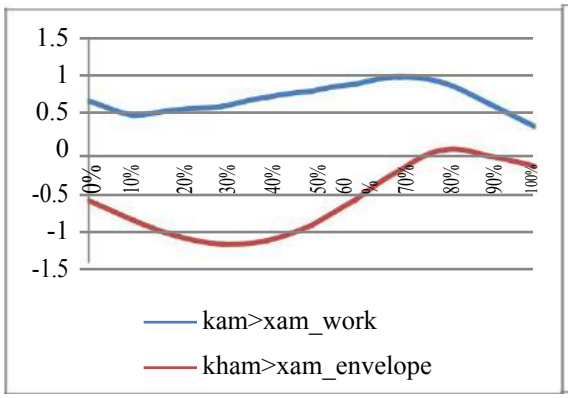

Fig 1: tonal minimal pair formed by deaspiration of k^hfollowed by lenition of /k/ and underlying k^h to x

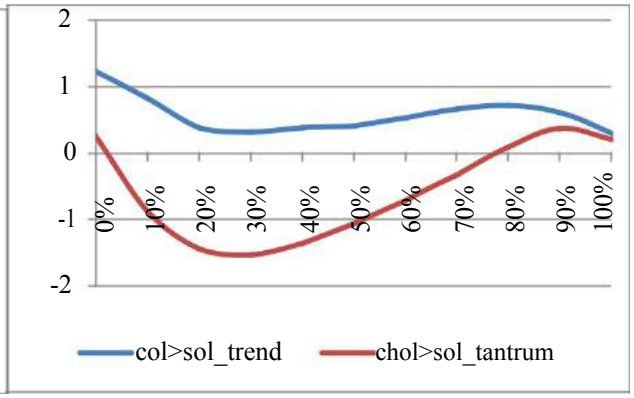

Fig 2: tonal minimal pair formed by deaspiration of /c^h/followed by lenition of /c/ and underlying /c^h/ to /s/

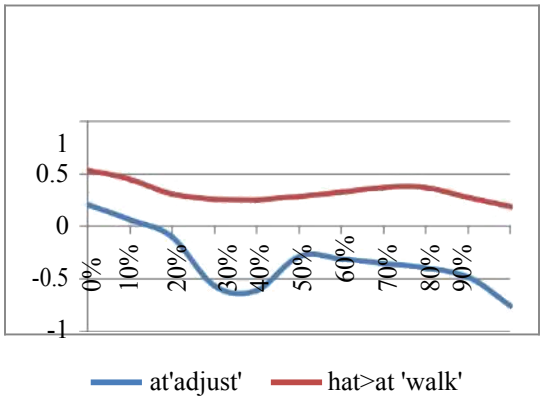

Fig 1: tonal minimal pair formed by /h/-deletion

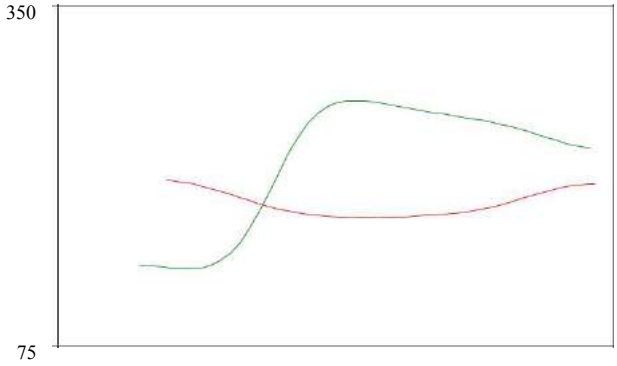

Fig3: har>ar 'lose' ʃar>har 'finish up'

Tonal minimal pair formed by /h/-deletion and debuccalization of /ʃ/ to /h/

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Gender and power in language change: comparison of two enclave communities

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Ethnicity and its role in language variation and change has only in recent years begun to be investigated as a factor in Canadian English (Boberg 2004, Hoffman & Walker 2010). However, studies from the U.S such as Popp et al (2003) and Filardo (1997) showing gender differences between African-America and Caucasian linguistic groups tell us that interactions between gender and ethnicity are crucial to understand ethnic variation. We thus undertake the study of two enclave ethnic communities in Western Canada with the aim to investigate how gender can interact in different yet important ways in these communities.

The first enclave community under investigation is the Filipino community in Winnipeg, Canada, an important transnational group which began immigrating to the city in the 1960s and which now makes up nearly 10% of the city's population, mostly living in enclave neighbourhoods in North-West Winnipeg. The second community of interest is the Mormon community in rural Southern Alberta, which makes up nearly 75% of the population in the region. Despite having moved into the area beginning in the late 1880s, the LDS community has 'largely remained a cohesive group reinforced by the social activities associated with their church' (Meechan 1998). These communities are being compared due to their strong social netwoks with differing gender roles in each. Mormon households tend to follow a traditional division of labour where women work primarily in the home, with men as the primary bread-winners, and church activities often divided by gender (Sykes 2010). On the other hand, Filipino migration is highly gendered, with higher numbers of Filipina women migrating to work, becoming the principal breadwinners in their families and the centre of the community (Bonifacio 2013).

Data of this study are a wordlist sample of 92 speakers overall, from Calgary, Filipino Winnipeg, Winkler Manitoba, Southern Alberta (SAb), LDS stratified by *age, gender, socioeconomic status, urbanity* and *ethnicity.* All of the tokens were aligned and measured using FAVE (Rosenfeld et al. 2011), and then categorized by two phonetic environments (/æ/, /æg/), where /æg/-raising away from a retracting Canadian Shift vowel /æ/ is a change in progress on the Canadian Prairies (Boberg 2010, Rosen & Skriver 2015, Swan 2016). The data are subjected to Euclidian distance comparisons, mixed-effects modeling and plotting in R.

Results reveal that within both enclave groups, young women pattern more closely with older women in their respective communities than in the three non-enclave communities under study, where apparent-time change in progress appear to be underway. However, interestingly, the Filipina young women are innovating significantly more than Mormon young women. Men across the board are slower to adopt these changes as expected, but Mormon men are adopting the change more in line with non-enclave Canadians, in contrast to Filipino men who are not at all adopting the change. We attribute these differences to differing gender roles within each community studied, finding that in these enclave communities, the gender with the economic power within the enclave group is further along in the innovative form. These findings show that the

generalization that women are linguistic innovators is more nuanced than normally reported, and suggest a broader and more intersectional approach taking into account ethnicity and gender is necessary when examining language in society.

Effect of Distributional Shape on Target Learning

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It is well established that sounds in languages change, and that they do so systematically. Sound changes such as vowel shifts follow a consistent pattern wherein each new generation of speakers takes the change a little bit further in the same direction as previous generations. However, why sound change occurs when it does, and why it follows the pattern it does, is not well understood. In this study we explore what might cause learners to overshoot their apparent target, in an effort to understand the why of sound change. Work on morphosyntactic language change has shown that the nature of variation in a learner's input affects whether the variation is acquired veridically or changed as it is learned (Hudson Kam, 2015; Hudson Kam & Newport, 2005, 2009). Interestingly, Labov (2001) noted that stable vowels form a normal frequency distribution, while vowels that are changing form a skewed distribution. This suggests that differences in the nature of the variation might also play a role in (the continuation of) *sound* change. Here, we investigate this possibility by asking whether learners exposed to a normal distribution are more likely to learn that distribution veridically than learners exposed to a skewed distribution, where veridical learning is defined as learning a category centered on the same mean as the input. We also ask if learners exposed to a skewed distribution move the mean of the sound category away from the mean of their input, as is seen in vowel shifts. We use a novel experimental technique to ask these questions, as it allows very tight control over input, as well as very fine measurement of output.

Method 21 adults (2 males) with a mean age of 21 (range 18-29) have participated (data collection is ongoing). Participants were told that they would hear a series of tones which had been produced by 20 amateur musicians, all of whom were trying to play the same note. Their task was to listen to the all of the attempts and then play the note they thought was the musicians' target. Participants responded using a digital theremin, an instrument that enabled the production of a continuous range of Hz. (We used tones to avoid the influence of native language vowels and the theremin to avoid differences in individuals' voice accuracy.) Importantly, the 'attempts' were not all the same (in terms of Hz). Instead, they varied around a mean with a range of just over a semitone. In one condition, the attempts had a normal distribution. In the other, the attempts had a skewed distribution (Fig. 1). There were 40 trials. For each trial, we recorded the output pitch, and computed the difference between this and the mean pitch of that trial's input tones.

Results Fig. 2 shows histograms of differences between input mean and output (all trials) for each condition. All participants had a tendency to overshoot the pitches a little (by 1.4 Hz on average, $p<.0001$), and a model with input condition, gender, and age as factors showed that the shape of the distribution did not have a significant effect on participants' output. Participants in both groups produced tones that were in the direction of higher

pitches (Fig. 3). Age was associated with a non-significant (p=.056) tendency to diverge more from the input mean with higher ages, a result that goes against findings that language stabilizes more with age. There was no significant interaction between age and condition. Despite the lack of effect for condition, these early results produced the same "sound change" in both conditions, suggesting the possibility that internally-variable categories could be a trigger of non-veridical vowel learning.

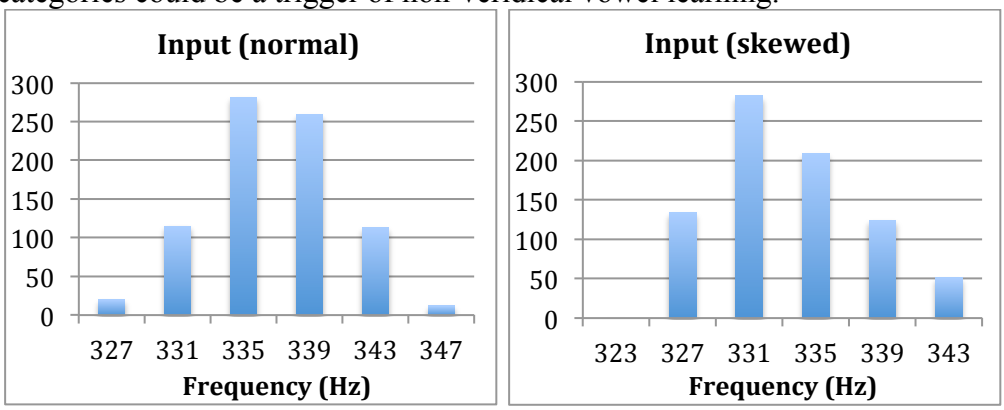

Fig. 1. Input distributions.

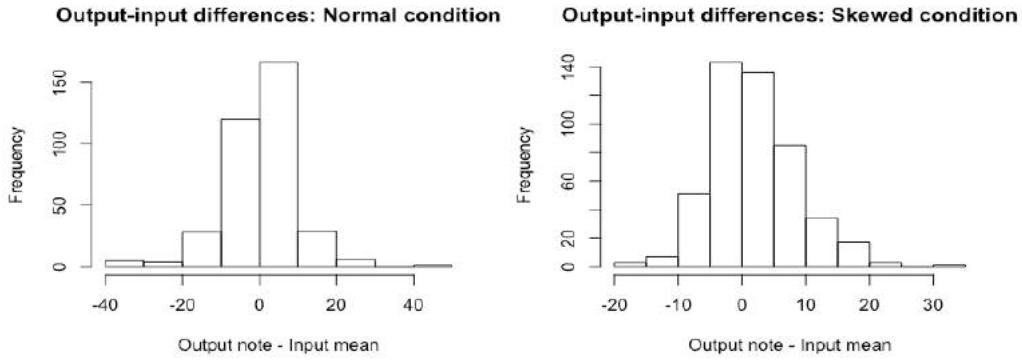

Fig. 2. Histograms, raw differences between output note and input mean.

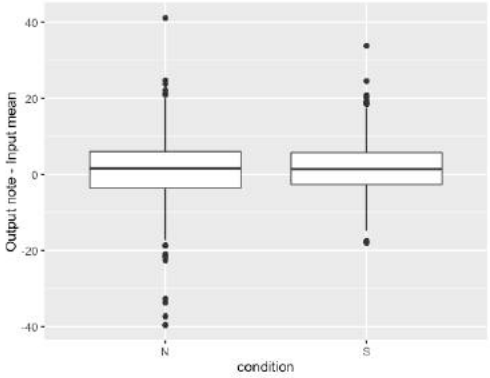

Fig. 3. Difference between output note and input mean, by condition.

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Intraspeaker variation and the actuation of sound change:

the case of Quebec French

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In recent years, it has been suggested that interspeaker variation in articulatory patterns could play an important role in the actuation of sound change. Among others, Beddor (2009) and Baker et al. (2011) find that individual differences in articulation can lead listeners to misinterpret what is initially a phonetic effect in their interlocutor's speech as the intended production target. Change is actuated, in those cases, when members of the community adopt the misinterpreted target in their own speech. I present data from Quebec French which suggest that *intra*speaker variation could be another factor that favors the actuation of sound change. More specifically, I look at the interaction between a change in the quality of pre-rhotic vowels and the idiolectal free variation between apical and dorsal variants of /R/.

Historically, the dorsal variant of the rhotic was used in Eastern Quebec (around Quebec City) while the apical variant was used in Western Québec (around Montreal). However, in the second half of the 20th century, the use of apical /R/ quickly declined in favor of the dorsal one (Clermont and Cedergren, 1979). Among western speakers born between 1930 and 1950, we find speakers who use only the apical /R/, others who adopted the dorsal /R/ categorically and others still who use both variants in free variation (Sankoff and Blondeau, 2007). Preliminary investigations of the *Phonologie du français contemporain* database (Côté, 2014; Durand et al., 2002, 2009) show that vowels before word-final /R/ are getting lower and more posterior. A likely phonetic precursor to the change is coarticulation with the dorsal /R/, known to have a lowering/backing effect on adjacent vowels (Delattre, 1971). The change in vowel quality, however, does not seem to start in Eastern Quebec, where the dorsal /R/ has been used for centuries. Interestingly, it seems to originate in Western Quebec, with the 1930-1950 cohort. Among this group, vowels are slightly lower and more posterior in the speech of speakers using the dorsal variant of the /R/ categorically than in that of the speakers who maintain the apical /R/. This supports the idea that coarticulation with dorsal /R/ could be the initial phonetic motivation for the change. However, the change is ultimately led by speakers who produce both apical and dorsal variants of /R/ in free variation. The pre-rhotic vowels of those speakers are lower and more posterior than those of the two other groups.

This result raises interesting questions about the production of allophones in free variation and the ability to attend to the distinct phonetic effects of those allophones. In this case, the actuation could result from the intermittence of the effect of a phonetic precursor in one's own productions. This suggest that a mechanism similar to what was found at the community level by Beddor (2009) and Baker et al. (2011) could be at play at the individual level.

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Linking Phonetic Convergence and Sound Change

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Introduction: Some models attribute sound change in part to speakers' tendency to sound more like their interlocutors (Yu 2013a), which is observed as *phonetic convergence* (Goldinger 1998). Not all speakers converge to the same degree, but there is limited work characterizing this variation and comparing it across measures (e.g. Pardo et al. 2015).

I demonstrate that convergence and individual change vary across speakers and across measures, but do not covary, and patterns exhibited by a speaker in one measure are not predictive of her patterns in other measures. I argue that while convergence data may provide a source of evidence for the spread of sound changes, such change must be considered separately for different characteristics, and I suggest that at least to the extent that convergence provides a parallel for sound change, sound change is not consistently spread by particular individuals.

Methods: 8 female native speakers of American English were paired with 1 of 4 female native speaker RAs in two tasks: (1) trivia (2) open-ended discussion. Phonological measures: F1, F2, F3. Prosodic measures: F0, intensity, spectral tilt. Speech rate measures: Durations of vowels, turns, and pauses. Values were z-normalized in to allow pooling for correlations.

Patterns of convergence: Not everyone exhibits the same patterns of convergence, but each individual is somewhat consistent in how she converges in different characteristics. Pairs with the same RA exhibited similar degrees of convergence, compared across measures. Among vowel formants (F1, F2, F3) $r(52) = .30$, $p < .001$ (see Figure 1); among prosodic measures (intensity, pitch, phonation) $r(52) = .42$, $p < .001$; among speech rate measures (duration of vowels, pauses, and turns) $r(52) = .13$, $p = .39$. Figure 2 presents non-phonological measures.

Convergence is also influenced by the conversational task, but speakers exhibit some consistency between different tasks, compared across measures. Among vowel formants: $r(34) = .36$, $p < .001$ (see Figure 3); among prosodic measures: $r(34) = -.23$, $p = .046$; among speech rate measures: $r(34) = -.11$, $p = .35$. Figure 4 presents non-phonological measures. There was no correlation in convergence between measures: mean $r(22) = -0.014$, $p = .95$.

Patterns of individual change: Patterns of individual change were not correlated with convergence: $r(94) = -0.055$, $p = .59$. Despite the correlations in convergence involving the same speaker, speakers exhibited little consistency in degree of change in different pairs, across measures: $r(94) = 0.31$, $p = .0013$, which can largely be attributed to task-based change; the correlation for change made by different individuals is $r(94) = 0.12$, $p = .24$, and the difference between these correlations is not significant: $Z = 1.36$, $p = 0.16$.

Speakers exhibited more consistency in change within different tasks in the same pair, across measures, $r(126) = 0.15$, $p = .087$; with change in each task from a different pair, $r(126) = -0.14$, $p = .11$. The difference between these correlations is significant: $Z = 2.31$, $p = .021$.

Discussion: Patterns in convergence and individual change can produce different predictions for sound change, because they are not correlated. Change is not necessarily propagated by the most variable speakers; it may be associated more with a tendency towards convergence.

Individuals can exhibit convergence more in some characteristics than in others, rather than exhibiting overall tendencies in convergence, which demonstrates the importance of considering convergence separately for different features. This may be associated with individual differences in sensitivity to different features (Yu 2013b). Once speech variants exist, it is not necessarily the same speakers spreading changes in different characteristics.

Figures

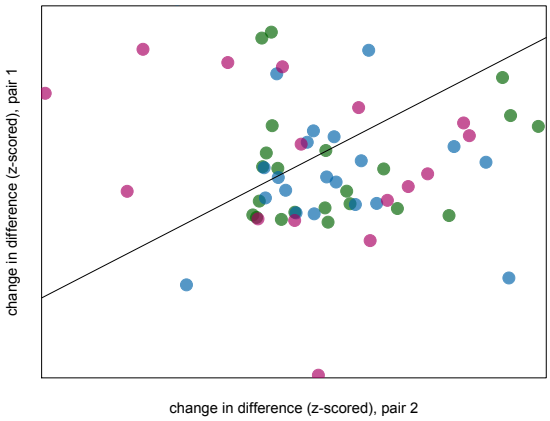

Figure 1: Correlation in formants, pairs with the same individual (F1: pink, F2: blue, F3: green)

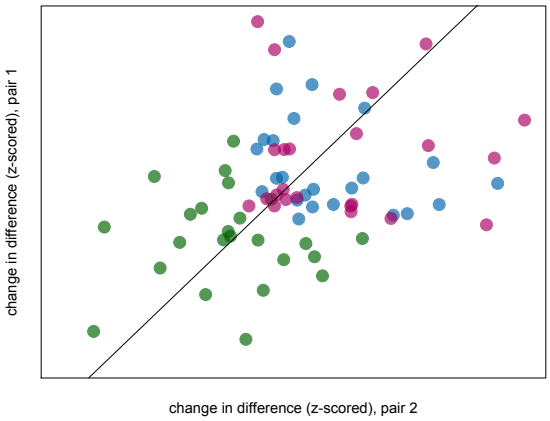

Figure 2: Correlation in non-phonological characteristics, pairs with the same individual (pause duration: green, pitch: blue, spectral tilt: pink)

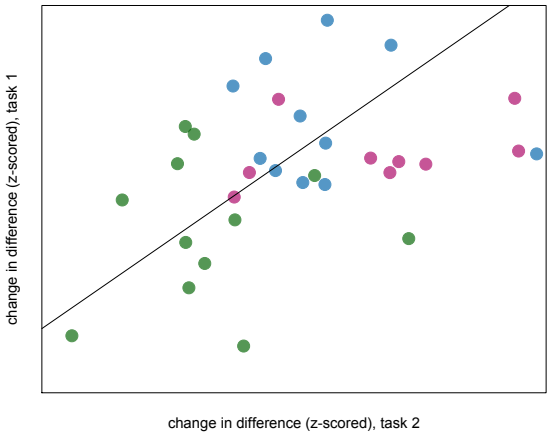

Figure 3: Correlation in formants, same pair different tasks (F1: pink, F2: blue, F3: green)

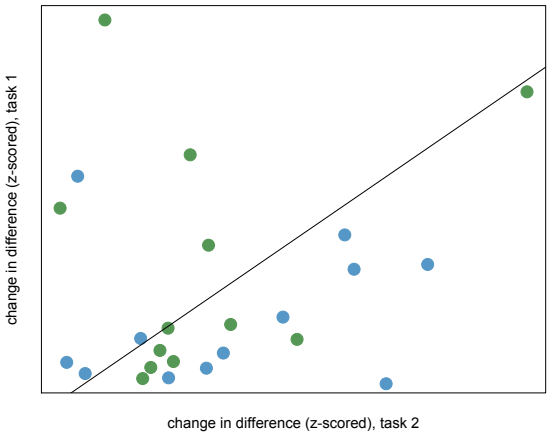

Figure 4: Correlation in non-phonological characteristics, same pair different tasks (intensity: green, pause duration: blue)

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Dialectal variation and change in production and perception of the Korean fricative contrast

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Introduction: This work documents dialectal variation and change in production and perception of the Korean fricative laryngeal contrast ("nonfortis" /s/ vs. the unambiguously fortis /s'/). Korean /s/ is notoriously ambiguous in terms of its place in the three-way laryngeal contrast (fortis vs. lenis vs. aspirated) that characterizes the rest of the Korean obstruents: while phonologically patterning with lenis stops (Iverson, 1983), /s/ shares phonetic properties with both lenis and aspirated stops (e.g. Chang, 2013). Given this ambiguous affiliation, Korean /s/ may be expected to be particularly susceptible to change. In previous work (Kang 2014), we found dialectal differences in the realization of /s/: while Seoul speakers produced /s/ with relatively high f0 (like aspirated stops), native Korean speakers living in the Liaoning province of China produced /s/ with low f0, like lenis stops. These patterns were suggestive of different trajectories of change in the realization of /s/ the two dialects. The current work follows up on these findings via a direct examination of change in production and perception of the fricative contrast in the same two dialects, focusing specifically on the use of f0 and aspiration, acoustic cues that are known to be undergoing change in the Korean laryngeal system more generally.

Methods: Native Korean speakers living in Dandong (Liaoning province) China (n=64) and Seoul (n=63) across several generations (born 1932-1996), balanced for age and gender, participated in production and perception tasks. In the production task, speakers produced two repetitions of fricative-initial words (disyllabic, preceding /a/) varying in laryngeal category (fortis /s'/ vs. nonfortis /s/). Aspiration (Korean nonfortis /s/ is phonetically aspirated) and f0 at vowel midpoint were measured. Stimuli for the perception task were manipulated from natural productions of one male and one female talker to vary along these same two dimensions, with endpoints chosen based on the production range of the speakers (aspiration: 3 steps, 0-90 ms; f0: 3 steps, 135-200 Hz for male, 200-335 Hz for female). Listeners heard the stimulus space (blocked by talker, 144 total tokens per talker) and chose whether they heard /s/ or /s'/ for each item.

Analysis: Statistical analyses of both production and perception data were performed using linear mixed-effects models. Predictor variables were 1) laryngeal affiliation (in production) or laryngeal response (in perception) (nonfortis /s/ vs. fortis /s'/), 2) year of birth, and 3) dialect. Separate models were built for each response variable (aspiration and f0) (*aspiration/f0 ~ lar * yob * dialect + (lar|participant)*). A significant interaction of laryngeal category and year of birth was interpreted as change in the use of/reliance on the given acoustic cue in production/perception.

Production results: Production results (by-participant z-scores of aspiration and f0) are shown in Figure 1. As expected, there was a robust contrast in terms of aspiration in all speakers (long aspiration for /s/ and no aspiration for /s'/), with no significant age-related differences. In terms of f0, the dialectal differences from previous work were confirmed. Dandong speakers produce substantially lower f0 for /s/ than /s'/, whereas Seoul show the opposite pattern: females produce slightly **higher** f0 for /s/ than /s'/ (opposite of Dandong), and there is no significant difference for males. No age-related differences were found in any of the subgroups; production patterns remain stable across time.

Perception results: Figure 2 shows participants' responses as a function of the values of aspiration and f0 in the perception stimuli. There was a significant use of both cues in both dialects, with lower f0 and longer VOT eliciting more nonfortis /s/ responses. The greater use of f0 by Dandong than by Seoul listeners reflects the dialectal asymmetry found in production (note, however, that Seoul listeners' use of f0 in perception is *opposite* of the small effect shown by Seoul female speakers in production). Interestingly, despite the stability of *production* patterns across time, there is a change in *perception* of the contrast in Dandong: younger listeners show increased reliance on f0, and decreased reliance on VOT, compared to their older counterparts. This change in perception, in the absence of a corresponding change in production, parallels, and is likely attributable to, a change in acoustic cue weighting of the laryngeal contrast in stops, demonstrating the indirect influence of the broader phonological system on change in perceptual representations of a specific phonetic contrast.

Figure 1: Normalized (z-score) values for aspiration and f0 of speakers' productions of nonfortis /s/ and fortis /s'/, by dialect, gender, and year of birth. Each point represents one production.

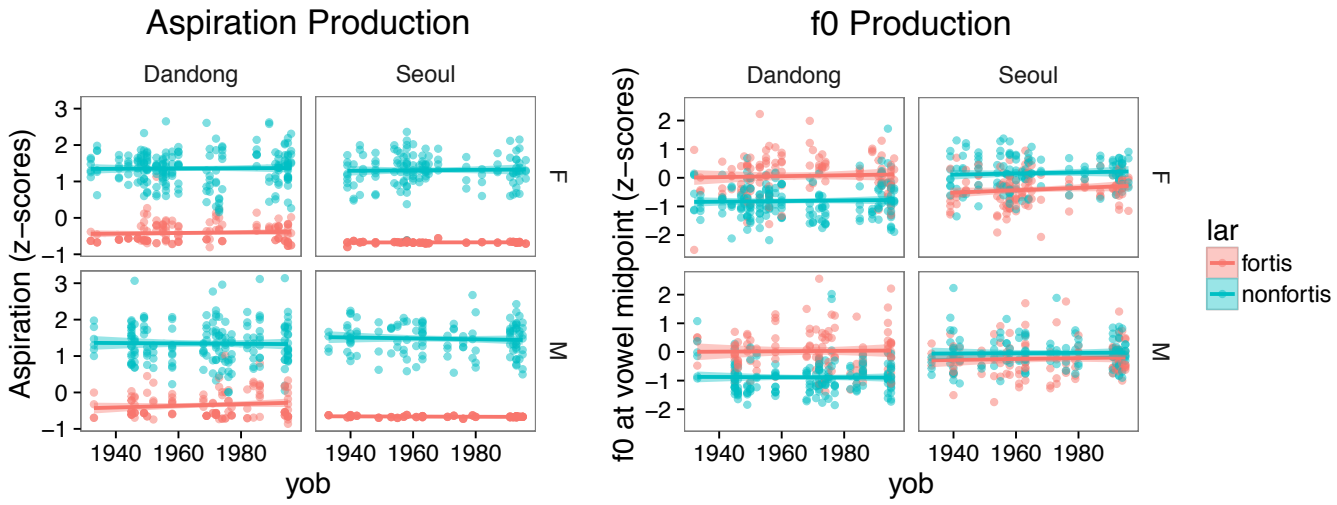
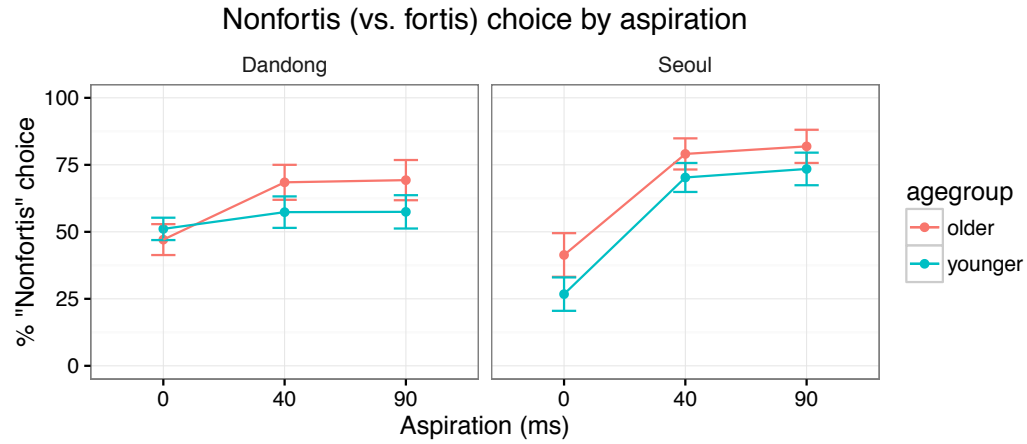
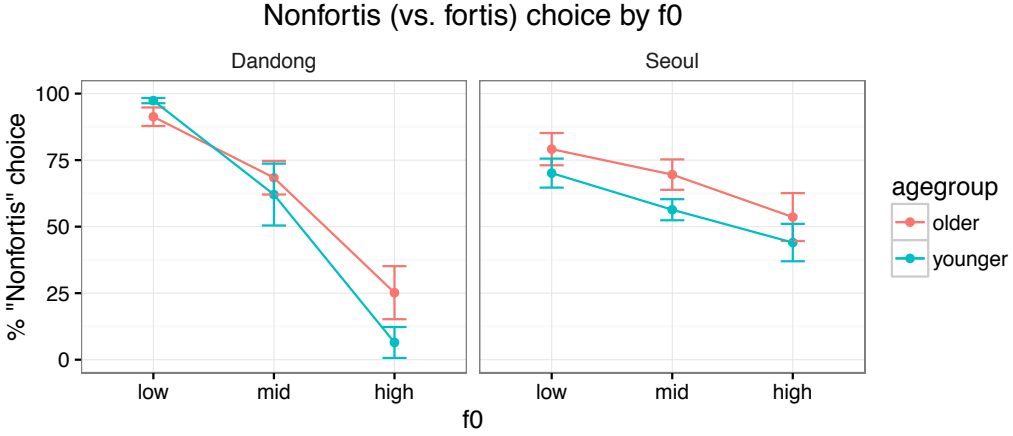


Figure 2: Mean percentage nonfortis /s/ (vs. fortis /s'/) responses in older and younger Dandong and Seoul listeners' perception of fricative-initial stimuli varying in aspiration and f0. Error bars represent 2 standard errors based on by-participant means.





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Sound change in Bernese German – Illustrated by Staub's Law

The atlas of German-speaking Switzerland (SDS) was published in 8 volumes between 1962 and 1997, containing more than 1500 dialect maps. In order to describe the variety spoken in the greater area of Bern (Berner Mittelland), Hotzenköcherle et al. collected data in 20 different towns and villages by questioning mainly NORMs, but some women have also been taken into account. In the SDS we find data on the greater area of Bern (Berner Mittelland), collected around 1944. Since then, only very specific factors of this particular linguistic variety have been examined, e.g. Hodler 1969 on Bernese German syntax, Marti 1976 on Bernese German grammar more generally or Siebenhaar 2000 on social varieties in the city of Bern, but the dialect has not been examined in its entirety. In my PhD project, I collect new data for Bern and its greater area according to selected variables already surveyed in the SDS, and compare them to the original data. My main focus is on sound changes and reasons for these changes. Moreover, I try to find out to what extent the high prestige variation of the city of Bern is spreading to the surrounding rural areas.

Staub's law (/n/ → ø_fricative; with vowel lengthening and/or diphthongisation) was postulated by Friedrich Staub in 1874, when he tried to explain the loss of /n/ in some Swiss German dialects. In the Berner Mittelland, sound changes according to Staub's law are documented in the SDS rather frequently, but mainly for rural areas where dialects with a slightly lower social prestige are spoken. Werlen (1977) points out that the pronunciation according to Staub's law is declining because of:

a) The coexistence of Standard German words which do not undergo sound change according to Staub's law and
b) The low social prestige of diphthongs, which normally result from changes according to Staub's law.

Therefore, we can expect to find less evidence of Staub's law in a contemporary data collection as in the historic data of the SDS. First analyses of the new data confirm Werlen's assumption of 1977, as the following table shows:

	Bern	**Belp**	**Worb**
SDS data	trɪŋkxə	trɪːxə	trɛixə
New data	trɪŋkxə	trɪŋkxə	trɪŋkxə

Whereas the SDS clearly documents variation in the pronunciation of the Standard German variable *trinken* (to drink) for the examined places, the contemporary data collection shows the already predicted decline in variation.

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Currently, more variables and places are examined in order to present the shift of the isogloss as soon as possible.

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Regularization can be explained by transmission noise alone

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Segment inventories in spoken language show a propensity towards regularity, i.e. they tend to have little or no gaps. This observation has been ascribed to biases in the learning process (Reali & Griffiths 2009; Pater & Staubs 2013; Ferdinand 2015), but there may be another, simpler explanation: transmission noise (Ohala 1981). This is an umbrella term for any discrepancy between the spectral value intended by the speaker and the value perceived by the listener, which may be due to imperfections in production and perception, background noise, etc.

I implemented transmission noise in a simple symmetric neural network model (in Praat: Boersma & Weenink 2016) with five groups of nodes: three place feature values ([labial], [alveolar], [velar]) and two voicing feature values ([–voice], [+voice]). In the initial state of the network, all place nodes are connected to all voicing nodes through connections with small and random weights (see Fig. 1a). The network is then fed combinations of features: in each learning step, the nodes that belong to the two feature values are activated, and the weights of the connections in the network are updated. The input tokens may be slightly scattered by the transmission noise, and since both features correspond to phonetic continua, this may also activate adjacent feature values: a labial sound may be perceived as mostly labial, but a tiny bit alveolar as well. The amount of transmission noise is normally distributed around a mean of 0; its magnitude and direction are random, so it does not favour any specific feature values.

After 10,000 learning steps (see Fig. 1b), the network speaks, i.e. it produces all six possible feature combinations. I quantified the output frequency of a segment as the summed weights of the connections between the feature values belonging to that segment: for instance, if the total weight of the connections between [labial] and [+voice] is twice as large as that of the connections between [alveolar] and [–voice], then /b/ is two times more frequent than /t/. The output of the network serves as the input to a new network, in which the learning process starts from scratch. This way, a chain of iterated learners is created.

Because the transmission noise sometimes activates neighbouring groups of nodes simultaneously, it may create connections between previously unconnected feature values: this way, new segments are introduced into the language. The pace at which new segments emerge depends on the amount of transmission noise (with more noise speeding up the process), but in any case, eventually a regular inventory emerges in which all segments have approximately the same relative frequencies (see Fig. 2). Thus, regularization happens non-teleologically in a very simple network under the feasible assumption that the language is sometimes transferred imperfectly.

Of course, the propensity towards regular segment inventories is only a tendency, and it can be counteracted by various pressures (e.g. biases in production and perception; restraints from the lexicon; etc.). Also, the simulation results do not preclude other explanations of regularization: for instance, empirical evidence suggests that the degree of regularization is related to the complexity of the input (Ferdinand 2015; Seinhorst, to appear), and variation and assimilation may have similar scattering effects. It seems that multiple independent factors are unintentionally achieving the same result.

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Example: an initial language with /p k d g/.

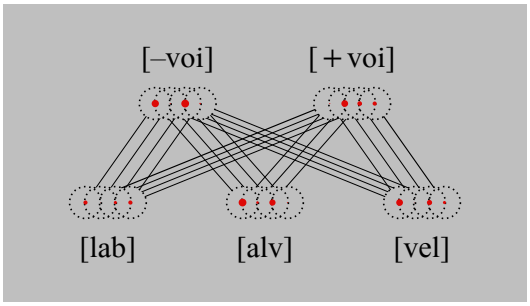

Fig. 1a. *A network in its initial state.*

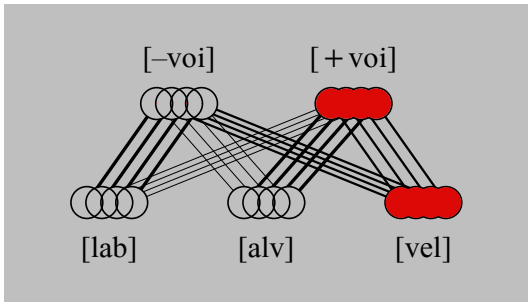

Fig. 1b. *The network from Fig. 1a after 10,000 learning steps (last input:* [g]*).*

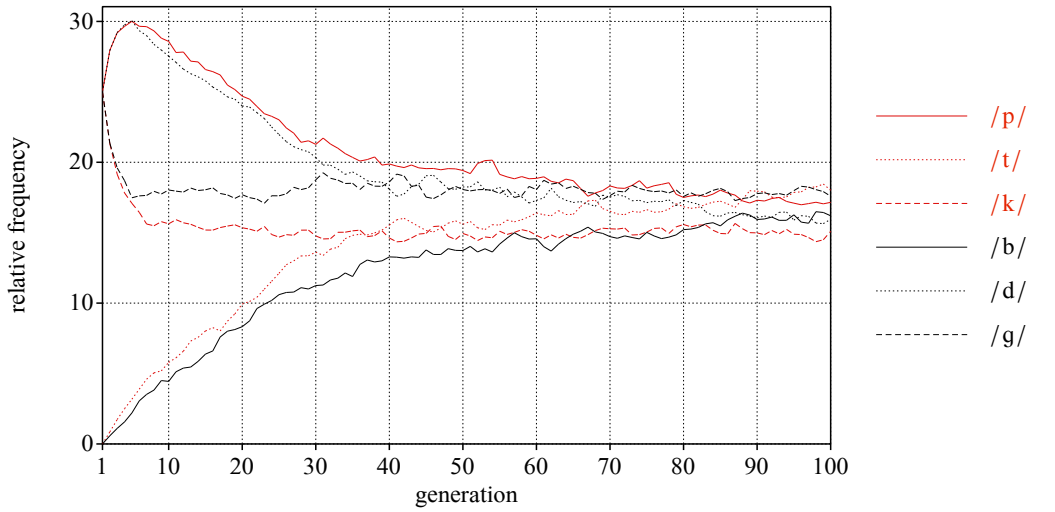

Fig. 2. *The frequency distributions of the six segments across 100 generations, averaged over 10 runs. Initially,* /p k d g/ *have equal relative frequencies (1 in 4, i.e. 25%), but after the emergence of* /t b/ *all relative frequencies eventually stabilize around 16.7% (i.e. 1 in 6).*

Understanding tonal change in tonal acoustic space: data from Northern Min Chinese

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The study of vowel has long benefited from the acoustic model of vowel space. While in the study of tone, although many tonal space models have been proposed (e.g. Holmbert 1978, Barry & Blamey 2004, Alexander 2010, Peng etc. 2012, Kuang 2013), none of them has been accepted as universal. This may own much to the language-specific nature of tonal perception, where different languages use different dimensions and different weight of importance (see for example Gandour & Harshma 1978, Brunelle 2009). However, language-specific tonal space may still be a useful tool for better understanding of tonal change, as argued in this paper.

The Northern Min has been well known for its complex tonal system (Norman 1973). Most of the varieties possess a dense tonal space with large number of tones, ranging from 6 to 10 tones. The data used in this study has been collected during three field trips to Jianyang (JY, also known as Kienyang) and Jianou (JO, also known as Kienow) in 2015, 2016. Isolated citation forms from four informants of each variety has been presented, and other contextual variation and perceptual data will be included in future study.

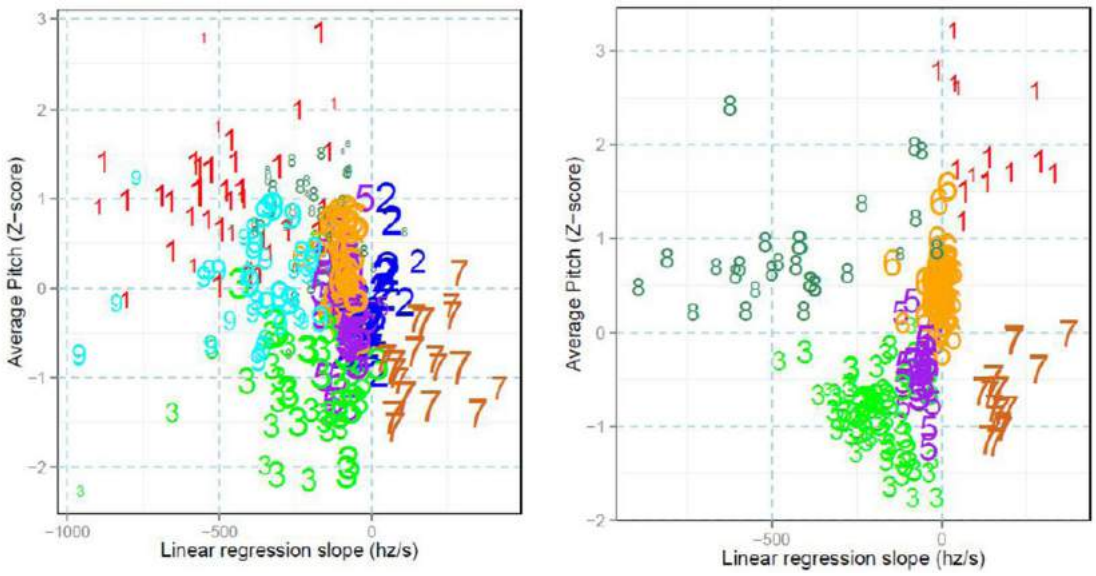
The 'Tonal Acoustic Space' (TAS) model (Shen 2016) has been used to analyze acoustic data from these two varieties (JY and JO). A three-dimensional TAS, composed of slope, height and length, has been proposed. A comparative study reveals that there are several phonetic and phonological tonal changes happen, most likely from JY to JO.

Compared to the conventional model, the TAS model has several advantages in understanding the mechanism of tonal changes. Firstly, TAS includes not only the mean value, but also the range of variation and their relative frequency. Second, the motivation of tonal chain shift is better understood in TAS. Last but not least, TAS is capable of detecting potential link between separated tonal changes and the role dispersion effect plays.

This study also reminds us of two important issues remain to be answered. The first is a hypothesis proposed by Michaud & Vaissière (2015), i.e. 'non-decomposable tones such as those of Vietnamese, Thai and Mandarin undergo a gradual phonetic evolution'. All the tonal changes in Northern Min Chinese identified so far are located in two continuous area in tonal space. It is worth investigating that whether this hypothesis hold true for other complex tonal languages in Asia and beyond. The second issue is about the universal vs. local effects in tonal evolution. Several mechanism of universality in tonal evolution has been proposed in recent studies (Pittayaporn 2007, Zhu & Li 2016, Yang 2016). In this study, we found that local effect plays a more important, if not dominant, role in Northern Min tonal evolution. It remains to be seen whether more universal rules of tonal evolution are to be identified and how these rules work in a local context.

Figure 1. Three dimensional TAS of JY (left) and JO (right)

(Slope presented by X-axis, Height by Y-axis, and Duration by the size of the number)



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Different nature of final glottalization gives rise to different sound change patterns: Evidence from a comparative study of two Chinese varieties

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Glottalization is defined in this paper as a cover phonetic term for complete or partial closure of glottis (Michaud 2005: 138), including different degrees, such as weak glottalization, creaky voice, and a full glottal stop (Frazier 2009: 62).

Final glottalization is very common among Chinese dialects, usually transcribed as ending in a glottal stop [ʔ]. In our early study on the comparison between final glottalization in Shanghai Wu and Chaoshan Min (Shen & Lin 2016), we found that final glottalization has very different nature in these two varieties, in terms of both phonetic details and phonological status.

In Shanghai Wu, the so called 'glottalized' syllables are realized as glottal stop ending only in phrase-final position; they are realized as short vowel in phrase-medial position. Phonologically, the glottalization is a by-product of short vowels, similar to the phenomenon found in Thai, where 'glottal stop may freely alternate after open, short syllables in the stress environment' (Slayden 2009: 8). Meanwhile, in Chaoshan Min, the glottalization is consistently present in both isolated and carried forms, although the phonation type varies (Pan 2016). In terms of phonotactics, glottalization co-occurs with diphthongs, while the timecourse is different from other final stops. Therefore, it is proposed that glottalization in Chaoshan Min is a suprasegmental feature associated with tonal register, similar to creaky tone found in Burmese (Watkins 2001) and Vietnamese (Michaud 2005).

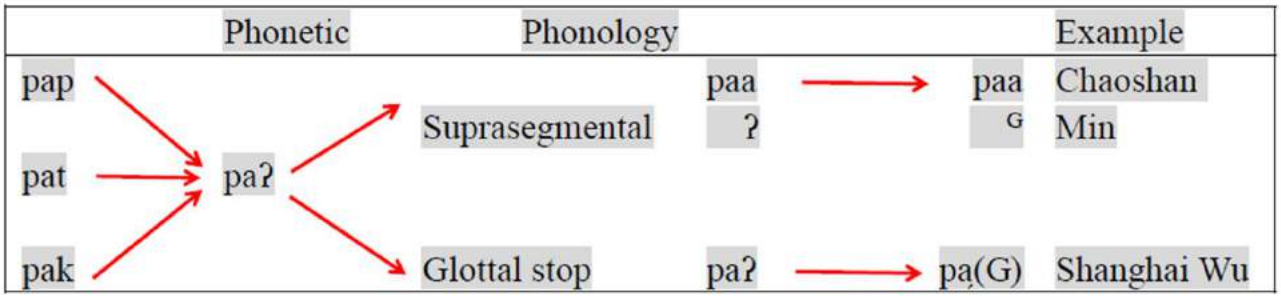
Based on these findings, this study further demonstrates that how different nature of final glottalization in these two varieties gives rise to different sound change patterns.

Through a comparison between Old Shanghai (after Qian 2003) and New Shanghai (after Chen 2008), it is found that: (1) Vowel changes and vowel mergers happen independently in two separate vowel spaces. (2) The ‘same’ vowels in different space differ in their evolutional paths. (e.g. while long/open /æ/ merge with /e/, short/glottalized /æ/ merge with /ɑ/). In other words, glottalization in Shanghai effects the evolution of preceding vowels, generating another vowel space. In contrary, parallel patterns between open and glottalizaed rhymes are found through a comparison between four varieties in Southern Min (data from Tung 1960). In other words, glottalization does not effect the evolution of vowels or rhymes in Southern Min.

Historically, final glottalization in both Shanghai Wu and Chaoshan Min developed from final stop *-p/-t/-k. Why these two varities have developed two different evolution patterns? The answer is most likely to be the double character of glottalization, which could be understood as either a glottal stop, or a suprasegmental phonation, or both. Two evolution paths are proposed in Figure 1.

In summary, the different sound change patterns result from the diverse phonetic and phonological nature of final glottalization, which were neglected by previous impressionist description. In order to deepen our understanding on the diversity and evolution of glottalization in different languages, further experimental studies need to be carried on glottalization in Chinese and beyond.

Figure 1. Two hypothesized evolution paths for final glottal stop.



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Raising or Lowering: The effect of aspiration-induced *f0* perturbation in Lili Wu

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The effect of aspiration on the onset *f0* of tonal realization in Chinese dialects has aroused much interest in the last decade (e.g. Xu & Xu, 2003; Lai et al., 2009; Chen, 2011). Lili Wu is known as a Northern Wu dialect which shows aspiration-induced *f0* lowering and it has been argued that this lowering effect leads to new lexical tonal categories after voiceless aspirated onsets (Chao, 1928 but see Shen, 1994 which argues that tonal contours after voiceless aspirated and voiced onsets are merged). Existing studies on the aspiration-induced tonal split have been mainly based on a limited number of participants. The general consensus is that the tonal split has occurred across the Middle Chinese (MC) tonal categories (except for the *Ping* Category). Furthermore, this process is a result of recent sound change (e.g. Ho, 1989; Shi, 1992). An alternative view on the tonal split, however, is that it is triggered by the breathiness of the following vowel, rather than the aspirated onset (Zhu & Xu, 2009). Given the current state-of-the art on *f0* lowering and tonal split in Lili Wu, this study aimed to examine the relation among onset aspiration, *f0* lowering, and vowel phonation, with a large data set elicited from speakers of three generations.

60 participants were recruited (old age group: 12 male and 8 female speakers born between 1933 and 1956; middle age group: 11M and 9F born between 1961 and 1976; young age group: 8 F and 12 M born between 1978 and 1994). Each participant read 36 real monosyllabic words with a three-way laryngeal alveolar contrast (/t tʰ d/) combined with the three vowels /a ə i/ in four MC tonal categories. Acoustic measurements included *f0* contours (with 10 equidistant points over the vowel for the short *Ru* tonal category and 20 for the rest of the MC tonal categories), voice onset time (VOT) which was further normalized for speaking rate (via dividing the raw VOT values by the duration of its following vowel). We also took the corrected H1*-H2* values over the one-third, middle, and two-thirds point of the vowels as an indication of the phonatory state of the vowels.

Preliminary results showed that *f0* lowering after an aspirated stop was not observed across the MC tonal categories and absent in the *Ping* category. This pattern holds across the three generations. The VOT ratio of the aspirated category was also rather stable across the three generations. Fig. 3 shows that aspirated stops generally introduced higher H1*-H2* values than unaspirated stops. The difference was mainly manifested during the first half of the vowel and often diminished after midpoint. This pattern again holds across the three generations. The phonatory state of the vowels after the voiced stop, however, seemed to have undergone on-going changes across the three generations. While data from the older generation showed more comparable patterns of H1*-H2* after the voiced and aspirated stops, data from the two younger generations showed a lack/minimized H1*-H2* difference after the voiced onsets compared to that after the voiceless unaspirated ones.

Taken together, our results call into question the commonly held view that the aspiration-induced tonal split in Lili is due to recent sound change but confirms that this effect is observed across all Middle Chinese (MC) tonal categories except for the *Ping* Category. Our results also raise serious doubts to the proposal that the Lili tonal split should be attributed to the breathy nature of the vowel of the tone-carrying syllable. Furthermore, we have observed

a consistently higher level of breathiness after voiceless aspirated onsets across the MC tonal categories while no *f0* lowering was observed in the *Ping* category, which suggests that a direct link between either aspiration or phonation with lowering *f0*/tonal split is not tenable. One on-going sound change we did observe is that breathiness after voiced stop onsets seems to be disappearing among the younger generation of the Lili speakers, which probably is due to its superfluous role in cuing the contrast between voiced and voiceless unaspirated stop onsets (where there is robust lexical tonal contour contrast) and that between voiced and voiceless aspirated stops (where VOT suffices as a robust cue).

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Segmental influences on F0: cross-linguistic and interspeaker variability of precursors to sound change

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Introduction: Sound change commonly involves phonologization of *phonetic precursors*: small phonetic effects assumed to hold across languages and individuals (e.g. Hombert et al. 1979). Yet relatively little is known about the *robustness* of most phonetic precursors: variability in their effect size across languages and speakers, which has important implications for sound change: establishing which precursors are robust enough to plausibly lead to change. Establishing the robustness of phonetic precursors is difficult because it requires large samples of comparable data from many speakers and languages. Two widely-studied precursors, which also form a good test case for an automated analysis, are the effect of vowel height and preceding consonant [voice] on F0 (called *VF0* and *CF0*; Kingston, 2007). This study assesses the degree of cross-linguistic and interspeaker variability in VF0 and CF0 effects across 14 languages, using large corpora of read speech.

Data/Analysis: We examined read sentences in 13 languages from *GlobalPhone* (Schultz et al., 2013)—Croatian, French, German, Hausa, Korean, Mandarin, Polish, Russian, Spanish, Swedish Thai, Turkish, Vietnamese ($\sim$20 hrs/language)—and English (using *LibriSpeech*; $\sim$2 hrs), all force-aligned using Aligner (Authors, 2016). We then extracted F0 contours (using Praat) for all {a, i, u} vowel tokens in each language in utterance-initial obstruent-vowel syllables. We transformed F0 to semitones (within-speaker), and performed data cleaning steps to exclude unreliable F0 measures (e.g. excluding <50ms vowels, speakers with multimodal F0 distributions). The resulting datasets contain 0.3k vowels from 67 speakers for English, and 2.4–7k vowels from 71–113 speakers/language for other languages. Two LME models were fit for each language of mean vowel F0 over (1) the whole vowel and (2) its first 50 ms, to assess VF0 and CF0. Each model contained fixed effects including preceding C manner and laryngeal class, vowel height, tone (where applicable), and by-speaker, word, and following segment random intercepts. The VF0/CF0 models contained by-speaker random slopes for height/laryngeal class, to assess interspeaker variability. We discuss VF0 model results for all languages, and CF0 model results only for the 12 languages with 2-way laryngeal contrasts.

Results: Fig. 1 shows the estimated VF0 and CF0 (2-way contrasts only) effect sizes for each language. The VF0 effect is positive in each language (high V > low V F0), confirming the near-universality of VF0 effects (e.g. Whalen & Levitt, 1995), but its *magnitude* varies greatly across languages (0.2–2.4 ST) and does not always reach significance (4/14 languages). The smallest effects are for languages that use F0 contrastively (tonal or pitch accent: Thai, Vie, Man, Swe, Cro) in line with work suggesting VF0 is actively attenuated in some in tone languages (e.g. Connell, 2002). The CF0 effect is positive in each language ([-voice]>[+voice] obstruent F0), regardless of how [voice] is phonetically implemented (e.g. 'true voicing' Croatian vs. 'aspirated' German), in line with Kingston & Diehl (1994). CF0's magnitude again varies greatly across languages (0.3–1.8 ST), but the effect almost always reaches significance (exception: Mandarin).

Fig. 2 shows the spread of VF0 and CF0 effects across speakers of each language estimated by the models: if the vertical line for a language overlaps 0, some speakers are predicted to not show a VF0/CF0 effect in the expected direction. Within-language interspeaker variability is generally large for both CF0 and VF0, enough for some speakers to show small or reversed effects. Also, the range of speakers values overlaps 0 more often for VF0 (12/14 languages) than for CF0 (7/12 languages), and languages often show more VF0 variability across speakers than CF0 variability (e.g. French, Turkish).

Discussion The existence of VF0 and CF0 effects are relatively robust across languages, confirming that they are possible phonetic precursors to sound changes. Their robustness across speakers is less clear: VF0 and CF0 effects show large interspeaker variability (within-language), and (tentatively) more for VF0. This may help explain why *neither* VF0 or CF0 effects from the preceding C often phonologize (Kingston, 2011), and possibly why VF0 in particular almost never does (Hombert, 1977). A methodological finding of this study is that VF0 and CF0 effects can be detected in non-laboratory speech with minimal statistical controls, despite not accounting for many factors greatly affecting F0 (e.g. intonation, stress), suggesting that large-scale studies

of phonetic precursors involving F0 are tenable. Such studies can shed new light on the robustness of phonetic precursors, and their relationship to community-level sound change.

Figure 1: Model-predicted VF0 effect (high vowel/low vowel difference; top) and CF0 effect ([-voice] obstruent/[+voice] obstruent difference; bottom) for each language, in semitones. Errorbars=95% confidence intervals ($\hat{\beta}\pm 1.96$ SE). Non-overlap of the errorbars with 0 corresponds to statistical significance ($|t| > 2$).

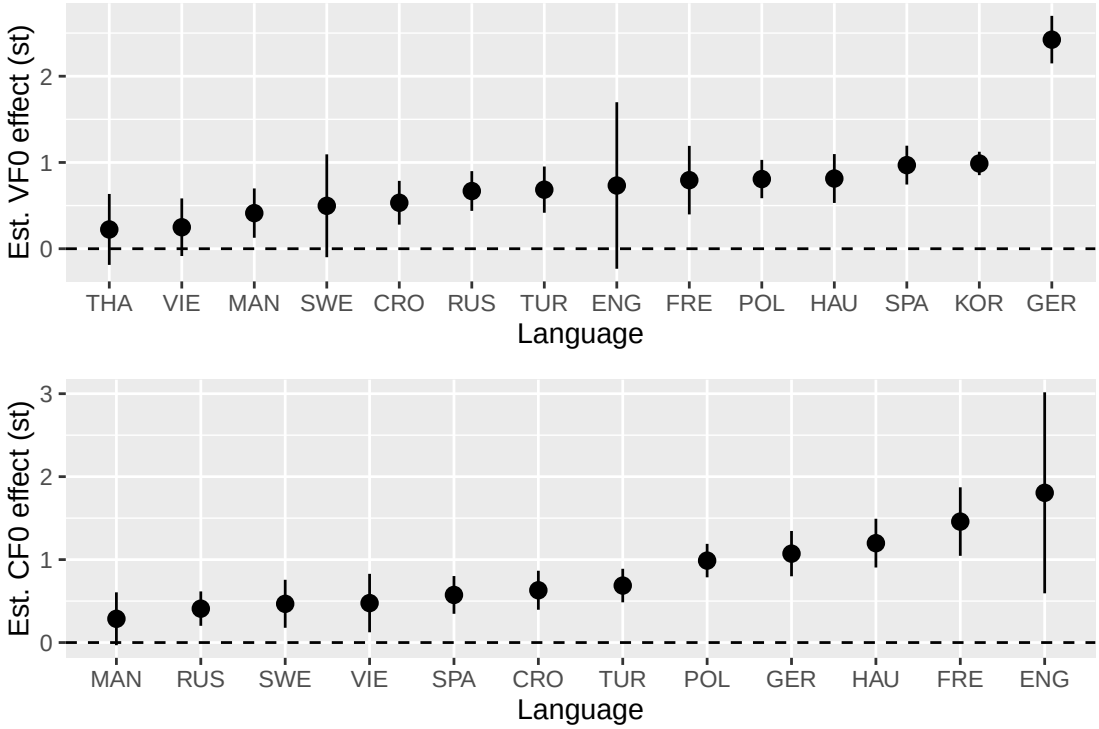
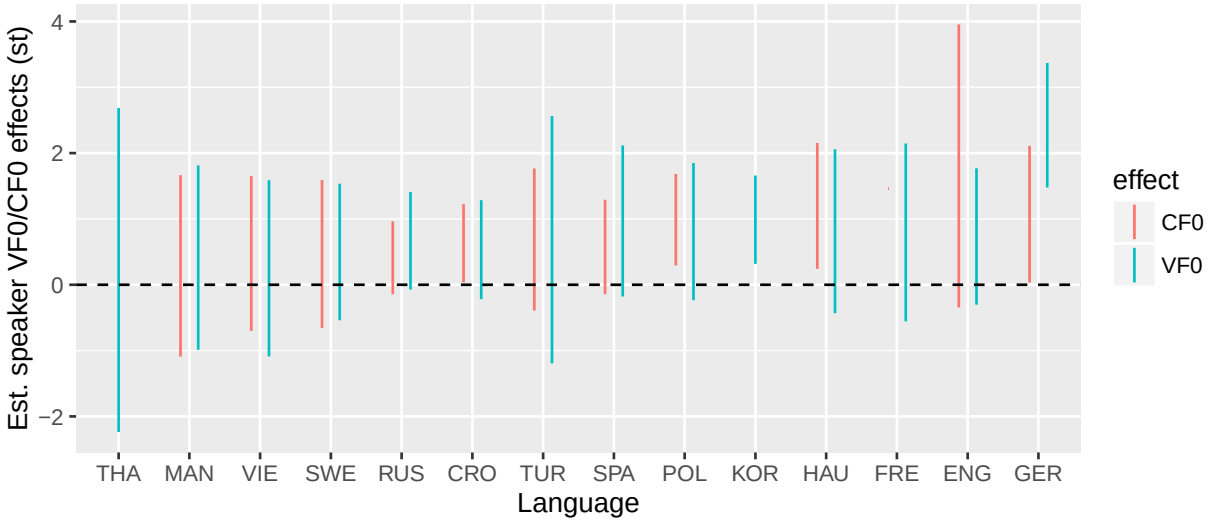


Figure 2: Model-predicted VF0 effects and CF0 effects , across speakers of each language, in semitones. Vertical bars = predicted range of values for 95% of speakers ($\hat{\beta} \pm 1.96 \times \sigma_{\text{by-speaker slope}}$).



The long and winding road between groups and individuals: a non-linear approach to changing liquids in Glasgow English

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Two fundamental challenges for studies of sound change are (i) striking the right balance between group and individual-level variation and (ii) effectively accounting for the dynamic nature of speech sounds. The former issue has received a lot of attention in work on the propagation and actuation of sound change (Labov, 2001; Stevens and Harrington, 2014). As the tension between groups and individuals is taking centre stage in sound change research, we need to ensure that our analytical tools are capable of handling these two levels. Linear mixed effects models provide a potential solution (Drager and Hay, 2012). The issue of speech dynamics is also becoming increasingly prominent in work on sociophonetics and sound change (Fox and Jacewicz, 2009; Cardoso, 2015). However, there is little work at the intersection of these two areas, owing partly to the inadequacy of linear models when it comes to speech dynamics. Models of dynamic speech data should capture non-linear variation in time-varying objects as a function of multiple variables both at the level of groups and individuals. In this work, we present a case study that illustrates how *generalised additive mixed models* (Wood 2006) can be used to address this problem.

We focus on real-time changes in the acoustic realisation of the liquids /l/ and /r/ in word-final position in Glasgow English (e.g. *tell*, *tear*). The data come from four sets of six older males and females recorded in the 1970s, 1980s, 1990s and 2000s. In previous LMM analyses of the same data (authors 2015, 2016), we found a diachronic rise in F3 for /r/ (loss of rhoticity) and a fall in F2 as well as a rise in F3 for /l/ (/l/-darkening). However, these analyses did not adequately control for duration, stress and the quality of the preceding vowel. Moreover, the LMMs did not include random slopes by trajectories or speakers and also did not allow for non-linearities, which can lead to unreliable and anti-conservative estimates (Sóskuthy, 2016).

In this paper, we reanalyse the same data using GAMMs. Around 35 tokens of /l/ and /r/ were identified for each of the 24 speakers. We analysed the entire rhyme (V + liquid sequence) for each token, extracting measurements for F2 and F3 at 11 evenly spaced points. In addition, we coded for duration, stress, preceding vowel quality, following segmental context (e.g. *tell and*), word type and log frequency (based on the British National Corpus; Burnard 2007).

Figure 1 shows a subset of the male F3 trajectories for /r/ to illustrate the complexity of the data set. The plot shows richly structured variation in average F3 values and trajectory shapes across individual speakers, decades, preceding vowels and durations.

GAMMs can bring this variation into the analysis by extending LMMs through (i) smooth terms that can capture non-linearities and may vary as a function of other predictors and (ii) random smooths (non-linear random slopes). We fit a GAMM to the data in figure 1 with smooths and smooth interactions representing the effects of decade, duration, stress, preceding vowel quality and word frequency, as well as random smooths by speaker, word, following context and trajectory. Figure 2 shows model prediction plots for the significant effects of decade, stress and duration. These plots reveal a much more orderly picture: F3 rises over time throughout the entire /Vr/ sequence (left), unstressed rhymes show greater reduction of /r/ (centre) and the transition between the vowel and the /r/ is much crisper in longer sequences (right).

Additional GAMMs fit to the /r/ and /l/ data confirm several previous findings and reveal further important details about the data. Similar to the previous studies, we found a significant rise in F3 as a function of decade for both liquids and both genders. We also found a rise in F2 for /r/, but only for front vowels, and a fall in F2 for /l/, but only for males. In addition, almost all of our models revealed some effects of duration and preceding vowel quality, but none of the models detected any significant frequency effects. Crucially, many of these patterns would be difficult or impossible to detect using traditional LMMs. Moreover, the use of random smooths by speakers forces the model to seek a balance between individual variation and group-level effects.

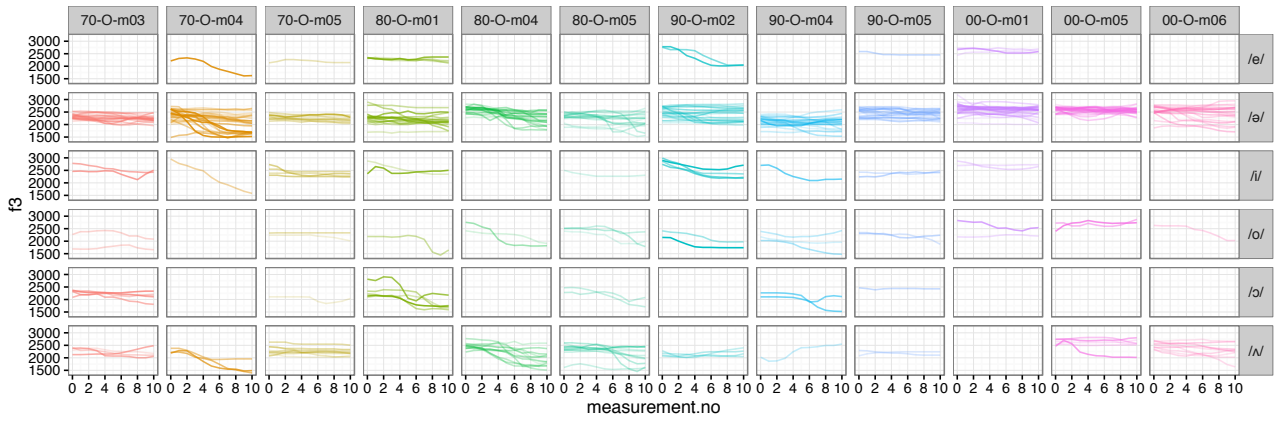

Figure 1: F3 trajectories for /Vr/ sequences from male speakers. The columns (and colours) represent speakers and the rows represent preceding vowels. Darker lines correspond to longer /Vr/ sequences. The speakers are ordered by decade of birth from left to right.

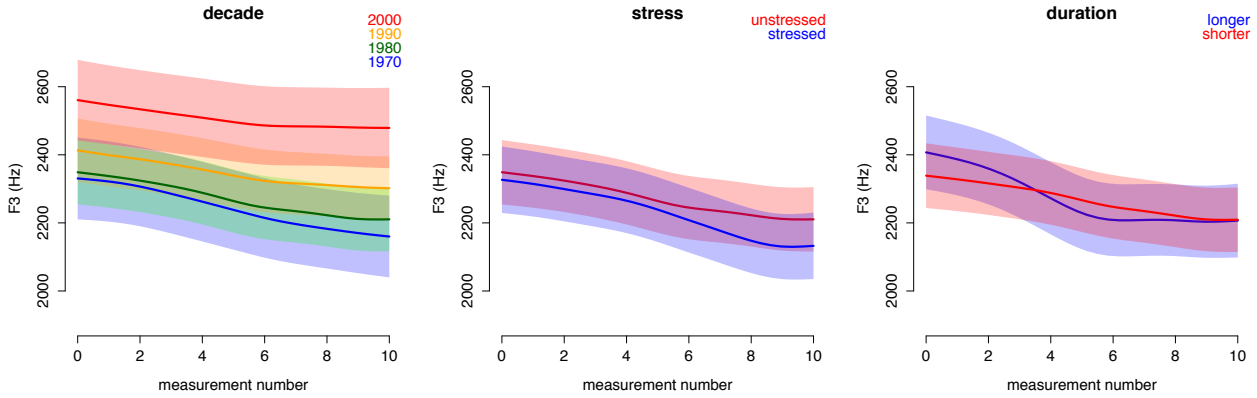

Figure 2: Model predictions for F3 trajectories representing /Vr/ sequences from male speakers. The plots show the effects of decade (left), stress (centre) and duration (right).

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Toward Building a More Comprehensive Sound Change Database

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Phonological researchers have access to many databases which list and categorize phonological inventories and processes according to language, language family, areal grouping, the role of stress, syllable complexity, tone system, and the presence or absence of individual segments, and other criteria. Among these are PBase: A Database of Phonological Patterns (Mielke 2006), the Lyon-Albuquerque Phonological Systems Database (LAPSyD; Maddieson, Flavier, & Pelligrino 2015), PHOIBLE (Moran, McCloy & Wright 2014), the World Atlas of Language Structures (WALS; Dryer & Haspelmath 2013), the South American Phonological Inventory Database (SAPhon; Stark & Chang 2012), and Ségerer's Consonant Inventories of African Languages database (2007).

Databases are useful in that they provide an interactive way for users to locate, sort, and interpret data that may otherwise be scattered across the literature. For example, PBase contains 7318 sound patterns exhibited by 629 languages represented (and searchable) by 8 feature systems and 398 features (Mielke 2008), and PHOIBLE includes 2155 inventories, 2160 segment types and 1672 distinct languages (Moran, McCloy & Wright 2014). Phonologists increasingly make use of databases to make typological comparisons between languages and language families (Wichmann & Saunders 2007), make claims about the relative crosslinguistic (in)frequency of individual segments and/or phonological systems (Blevins 2006), and support hypotheses regarding the (un)commonness or (un)naturalness of specific synchronic phonological processes (Mielke 2010).

Historical phonologists currently don't have access to the same quantity or quality of searchable resources. Many high quality volumes that catalogue historical sound changes exist, such as Martin Kümmel's *Konsonantenwandel* (2007), which includes over 200 Indo-European, Uralic, and Semitic languages. Kümmel limits himself to consonant changes, and classifies them as "changes in articulation type" (which includes changes in manner and laryngeal status), and "changes in the place of articulation." Each individual process is then listed along with each language where it occurs and its conditioning environment, if any. Kummel's volume is an excellent reference tool, but it not the most user-friendly, as it is necessarily rife with abbreviations and is a book. While there are a few diachronic databases available, they are generally not as sophisticated as their synchronic counterparts, and appear to have potentially been abandoned. UniDia, one of three diachronic databases under the DiaDM umbrella, is advertised as a database dedicated to historical sound change, and boasts 10,349 sound changes present in 302 languages (Ben Hamed & Flavier 2009). While its aim "to explore the overall consistency of the sound change hypothesized across language areas and families and to distinguish the specific from the 'universal'" is an admirable one, the database is currently listed as under construction and but was last updated on 8/2/2013 (ibid).

For my dissertation, I am working to continue building a searchable, more comprehensive database representing a wide variety of languages, language families, sound changes, and search parameters, as well as the tools to search its contents and export relevant information. Essentially, I hope to create a database like PBase but for historical sound change. When PBase was originally built, so was a sister infrastructure to facilitate the future development of a historical sound change database. I will have access to this infrastructure and the project's next steps include continuing to enter and code sound changes. The attendees of WSC4 are all potential users of this database, and as such, I am hoping to use their input from a poster presentation to make the database as useful and functional as possible when it launches. A centralized searchable tool has the potential to save researchers time by providing a quick way to access data and references. Additionally, the availability of frequency and occurrence information will allow for historical sound change hypotheses to be refined, supported, or revisited, as Kümmel does in the third section of *Konsonantenwandel*, but on a broader scale. As Honeybone noted in his 2009 review of *Konsonantenwandel*:

> All standard segmental historical phonologists need to develop a feeling for which kinds of changes are 'common' (or 'likely', 'natural' or 'possible') and which are 'unnatural' (or 'impossible'). This feeling is typically developed through a combination of experience, working through the histories of languages, and inherited wisdom, gained through reading textbooks or discussion with others. It's a rather haphazard basis for science: it would be really helpful if there were a systematic collection of types of changes, as found in the history of the languages of the world, ordered on a phonological basis, from which we could extract generalizations on a firmer basis about which changes happen commonly and what kinds of things are not found at all. This book aims to fill this need, and, as a historical phonologist, I'm grateful for it. (p. 280)

I also aim to fill this need by aggregating the work of scholars and making it easily accessible, searchable, and quantifiable.

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Gestural delay or gestural reduction?
Covert articulatory variation in ongoing /l/-vocalisation

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/l/-vocalisation is often characterised as a reductive sound change, in which the tongue tip (TT) gesture is reduced and/or delayed (e.g. Gick 1999). Both gestural delay and reduction have been evidenced by previous articulatory studies of /l/-vocalisation in different accents of English (Scobbie et al., 2007; Lin et al., 2014). However, there has been relatively little research on whether the two are always correlated, or whether they are two different articulatory strategies for achieving the acoustic effect of vocalisation. We attempt to tease apart spatial reduction and temporal delay as contributing factors in ongoing /l/-vocalisation in Southern British English (SBE).

Our data set includes high-speed ultrasound (121 fps) recordings of 864 tokens of /l/ in three contexts: i) word-final pre-consonantal (*fool#five*); ii) word-final pre-vocalic (*fool#it*); and iii) word-medial (*fooling*). The preceding vowels were /uː/ and /ʊ/. These tokens were produced by 12 speakers of SBE: 7 younger and 5 older.

For all the /l/ tokens, we identified the point of maximum tongue tip raising (TT gesture), and measured the time lag between TT gesture and the acoustic offset of /l/ (the offset of voicing, or the beginning of the following segment, depending on context). In addition, for all three contexts, we measured the degree of aperture, following a method based on Lin et al. (2014).We also measured the first two formants towards the end of /l/ (at 90% of /Vowel+l/ sequence), since previous studies indicate that decreased F1-F2 distance as a primary acoustic correlate of /l/-darkening and /l/-vocalisation (Carter, 2002; Lin et al., 2014).

In our speaker group, there were two advanced vocalisers: YF4 and YF6 (see Figure 1). YF4 consistently produced TT gestures that were, however, considerably reduced and delayed beyond the offset of voicing (by 54 ms on average). YF6 did not produce identifiable TT gestures in the *fool#five* context. For her, TT raising blended with the transition into the following segment.

The remaining 10 speakers typically produced clearly identifiable and audible TT gestures that differed, however, in timing and magnitude (example data are in Figure 2). We used data from these speakers to analyse delay and reduction in incipient /l/-vocalisation, using linear mixed-effects regression analysis. Gestural lag was a significant predictor for reduction: reduced gestures are typically also quite late. This, however, is speaker dependent: whereas some speakers show a correlation between delay and reduction, others do not. We also find that there is more TT reduction in word-final /l/ compared to word-medial or word-final pre-vocalic. Increased reduction is correlated with decreased F1-F2 distance. The timing of the TT gesture is best explained by segmental duration: the shorter the /uːl/ sequence, the closer the TT gesture to the offset of voicing. Reduction, on the other hand, is not a significant predictor of gestural delay, which suggests that the TT gesture may occur relatively late, yet be fully realised. Relative delay of the TT gesture has the same effect on F1-F2 distance as gestural reduction: the later the gesture, the smaller the F1-F2 distance.

In sum, we find that reduced TT gestures are also typically delayed, but the reverse is not true: TT gestures may be delayed without being reduced. Furthermore, both delay and reduction are associated with F1 and F2 coming closer together. Our findings indicate that gestural delay may be an independent mechanism in the actuation and propagation of /l/-vocalisation, similarly to what has been proposed for Glasgow English derhoticisation (Lawson et al., 2016). Our results are also consistent with a sound change scenario, in which gestural reduction is not a primary factor in actuation of

/l/-vocalisation, but rather, reduction is a consequence of delay, which then stabilises diachronically, for instance, through perceptual reinterpretation.

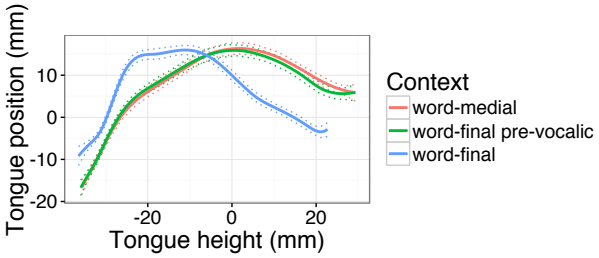

Figure 1: Data from a categorical vocaliser, YF6. The figure shows averaged tongue shapes for /l/ preceded by /uː/ extracted at the acoustic offset of the /l/. Tongue tip is on the right.

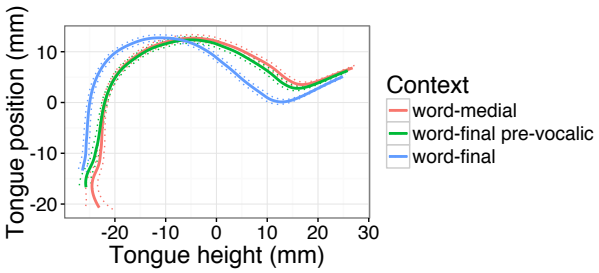

Figure 2: Data from speaker YF7 who has gradient reduction of TT gesture in word-final /l/. The figure shows averaged tongue shapes for /l/ preceded by /uː/ extracted at the TT maximum. Tongue tip is on the right.

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Individual differences in the phonetic realization of the Japanese word-initial stop-voicing contrast across dialects, ages, and genders

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Japanese is usually described as contrasting voiced /b, d, g/ to voiceless /p, t, k/ word-initially and medially. In Old Japanese, however, voiced stops are attested only medially, where they are reconstructed as prenasalized stops. Initial /b, d, g/ developed (1) from the loss of initial vowels and (2) from the influx of loanwords from Middle Chinese.

(1) i^{n}daku > [daku] 'embrace' (2) [budo:] 'grape' (cf. Shànghǎi [bu1dɔ5])

The philological evidence for prenasalization is augmented by variation in transcribed reflexes of medial /b, d, g/ across modern dialects (see, e.g., Hirayama 1968, Fig. 1). Work by Takada (2011) and colleagues provides instrumental evidence that word-initial voiced stops also vary across modern dialects, as well as across ages and genders, as illustrated in Fig. 2. Whereas all of the older Tokyo area speakers and most of the younger male Tokyo area speakers have lead VOT (prevoicing) in the majority of tokens of /b, d, g/, most of the Tohoku dialect speakers produce few or no tokens of /b, d, g/ with lead VOT. Fig. 2 also shows a variety of degrees of overlap between the VOT values in "devoiced" /b, d, g/ versus /p, t, k/, although Tohoku dialect speakers generally show less overlap. In this paper, we explore how individual differences in the robustness of the VOT cue relates to individual differences in other cues, including measures of pitch and voice quality.

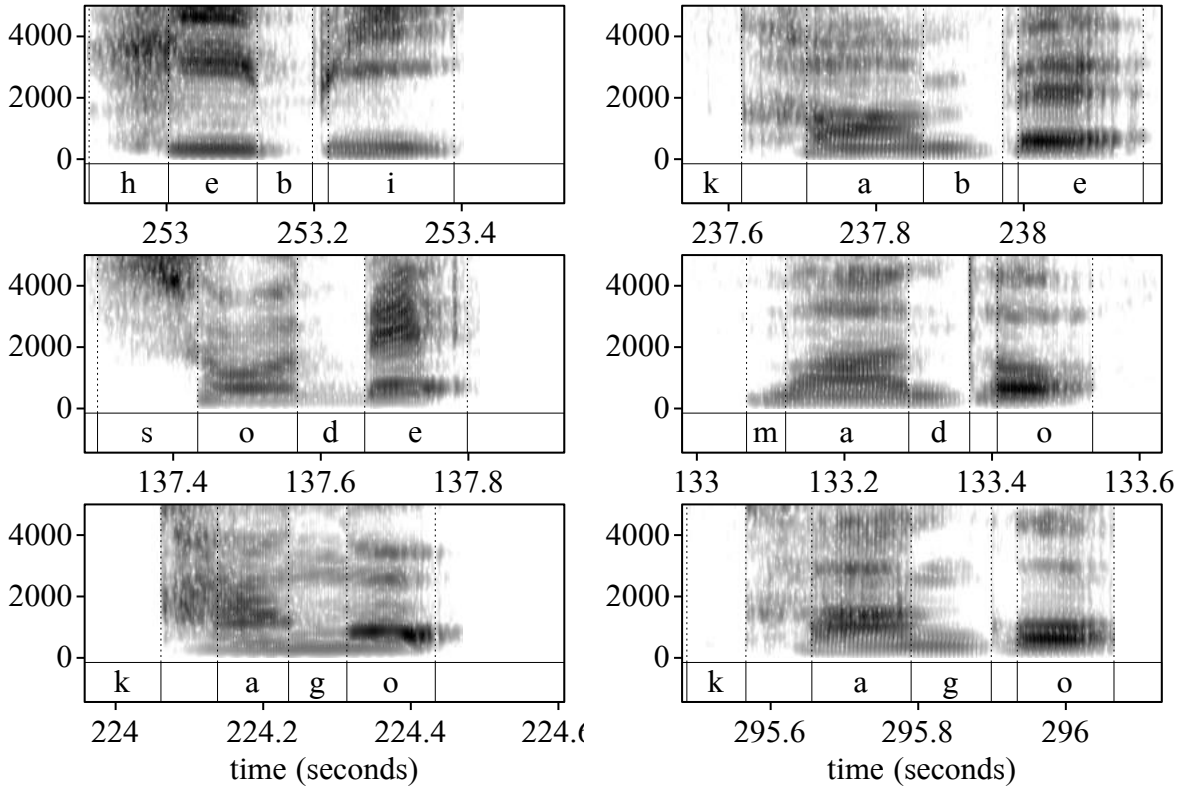

Figure 1. Examples of word-medial [$^{\beta}$b, d, ŋ] produced by a 78-year-old Tokyo-area female (left) and of word-medial [^{m}b, ^{n}d, ^{ŋ}g] produced by a 78-year-old Akita female (right).

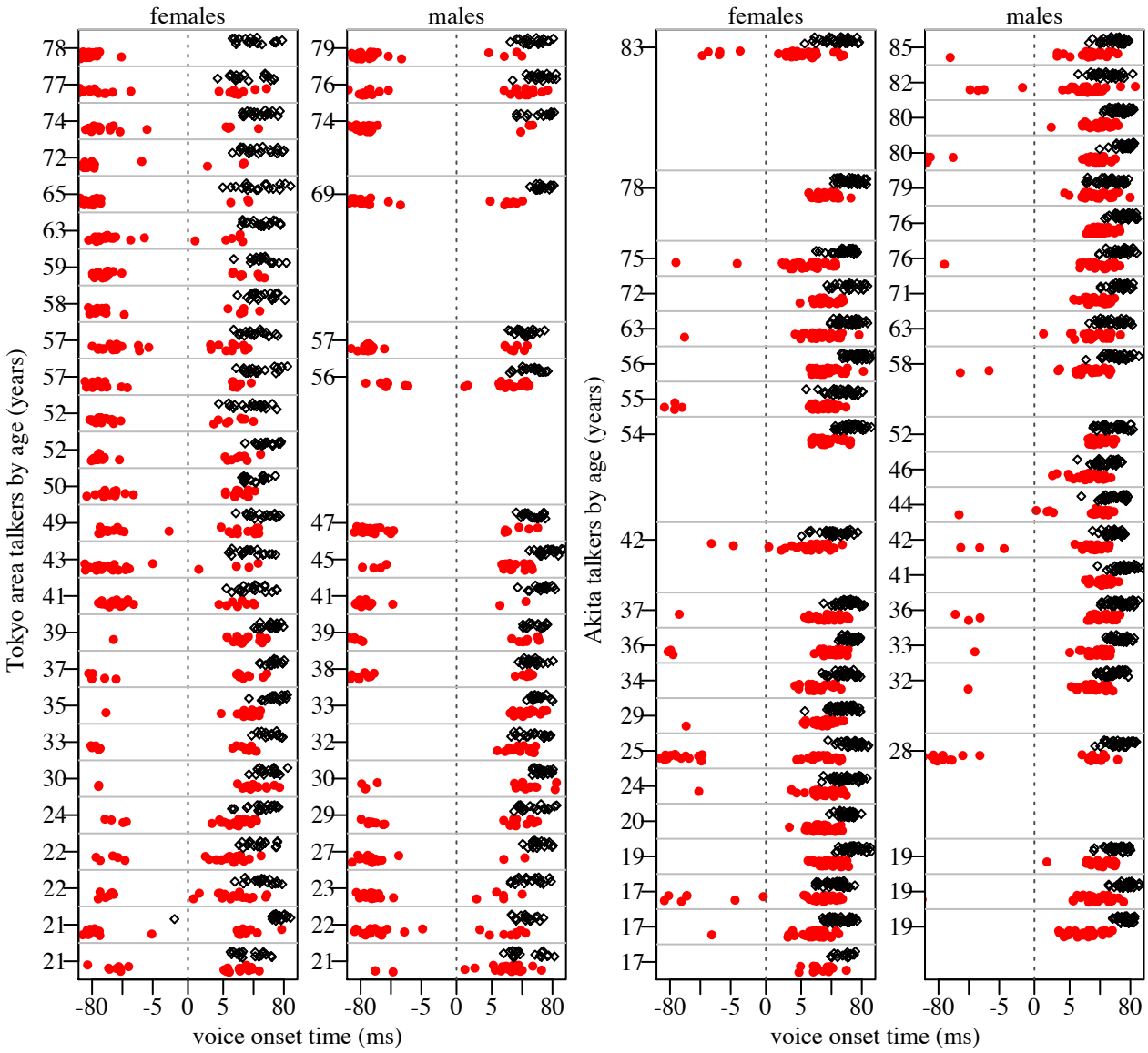

Figure 2. Voice onset time (ms, log scale) in initial /b, d, g/ (red circles) and /p, t, k/ (black diamonds) in read word-list productions by Tokyo-area speakers (left) and by Tohoku-area speakers (right) recorded in the early 2000s.

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Reanalysis of Tyneside linking /r/: Are younger speakers reversing the trend toward word-level deletion?

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Non-rhotic varieties of English, which exhibit deletion of coda /r/ word-finally (e.g. *pour* [pɔ:]), tend to retain /r/ in linking position i.e. before a vowel when the /r/ is resyllabified into the following word (e.g. *pour it*). This process is reported as near-categorical for dialects as broad as RP (Cruttenden 2008), Norwich (Trudgill 1974), Derby (Foulkes, 1998), London (Tollfree 1999) and Manchester (Turton 2010). However, this is not the case for Tyneside English, where speakers of varying ages and social classes show variable realisation of /r/ in linking contexts. In his study of Tyneside, Foulkes (1997) found a trend towards deletion of /r/ in linking position, led by younger working class speakers, who showed rates as low as 32%. Foulkes suggests that this is possible rule inversion, and that younger speakers are now showing a rule in which /r/ is inserted, which explains the lower rates, as there is no underlying /r/ present.

An alternative hypothesis is that speakers may be advancing to the next stage of deletion of coda /r/, as predicted by the life cycle of phonological processes (Bermúdez-Otero 2015). The life cycle would predict the phrase level /r/ deletion we see in most non-rhotic varieties could advance to the word level, so /r/ would delete in a phrase like *pour it*, even though it is resyllabified into the onset. Table 1 shows a subset of the possible typology of /r/ systems, where word-level deletion is represented by South African English, which is reported as having no r-sandhi (Hartman & Zerbian 2010). In Table 1, the pattern found by Foulkes (1997) would represent a variable stage between RP and South African English.

	terrain	*very*	*pouring*	*pour a*	*pour*	
American English	[ɹ]	[ɹ]	[ɹ]	[ɹ]	[ɹ]	*various*
RP	[ɹ]	[ɹ]	[ɹ]	[ɹ]	∅	Cruttenden (2008)
S.African English	[ɹ]	[ɹ]	[ɹ]	∅	∅	Hartman & Zerbian (2010)
Broad non-rhotic	[ɹ]	∅	∅	∅	∅	Harris (2006)

Table 1: /r/ realisation in various contexts across accents of English

The present study revisits the speech community 20 years on to investigate whether young Tyneside speakers are now closer to the stage in Table 1 represented by South African English than RP, *and* whether this occurs alongside or instead of reanalysis of the rule. We auditorily code interviews from the Diachronic Electronic Corpus of Tyneside English (DECTE). The results show that, in fact, when we append the new data to the average rates reported by Foulkes, we find the exact opposite of the predicted result: younger speakers are reversing the trend, with speakers born in the 1990s producing around 75% linking /r/ (Figure 1). We present an analysis whereby it is argued that this situation is consistent with rule inversion, but not necessarily the same picture painted by Foulkes. Speakers from the earlier generations exhibited an r-deletion rule which applied variably at the word level, affecting *pour it* as well as phrase level *pour*. Speakers born in the 70s increased their use of /r/-deletion, but our youngest speakers, we argue, have reanalysed this as an insertion rule, incrementing the perceived insertion of around 50% of the middle generation back to 75%. We discuss the implications of this pattern for theories of sound change, and what access a speaker has the community grammar in terms of direction of change, and awareness of rates of application within generations of older speakers. In addition, we consider the role of the individual in such processes. Not all younger speakers show this trend (Figure 1), which demonstrates that variability in such reanalysis can be highly unstable. The role of the individual in such circumstances may give us a unique insight into how entire communities change over longer periods of time.

One missing piece of the puzzle in this investigation thus far, is the realisation of intrusive /r/, whereby speakers produce an /r/ which was not present etymologically e.g. *draw it, vodka and tonic.* The status of variability in intrusive /r/ could provide a picture into how speakers treat an insertion rule, but tokens are too low to draw any conclusions (average of 2 tokens per speaker in present dataset). We discuss the implications for our hypothesis given we should expect younger speakers to also be showing high rates of /r/-intrusion. Nevertheless, if our story is true, it raises interesting questions for theories of sound change and a speaker's knowledge of the recent history of sound changes within the speech community.

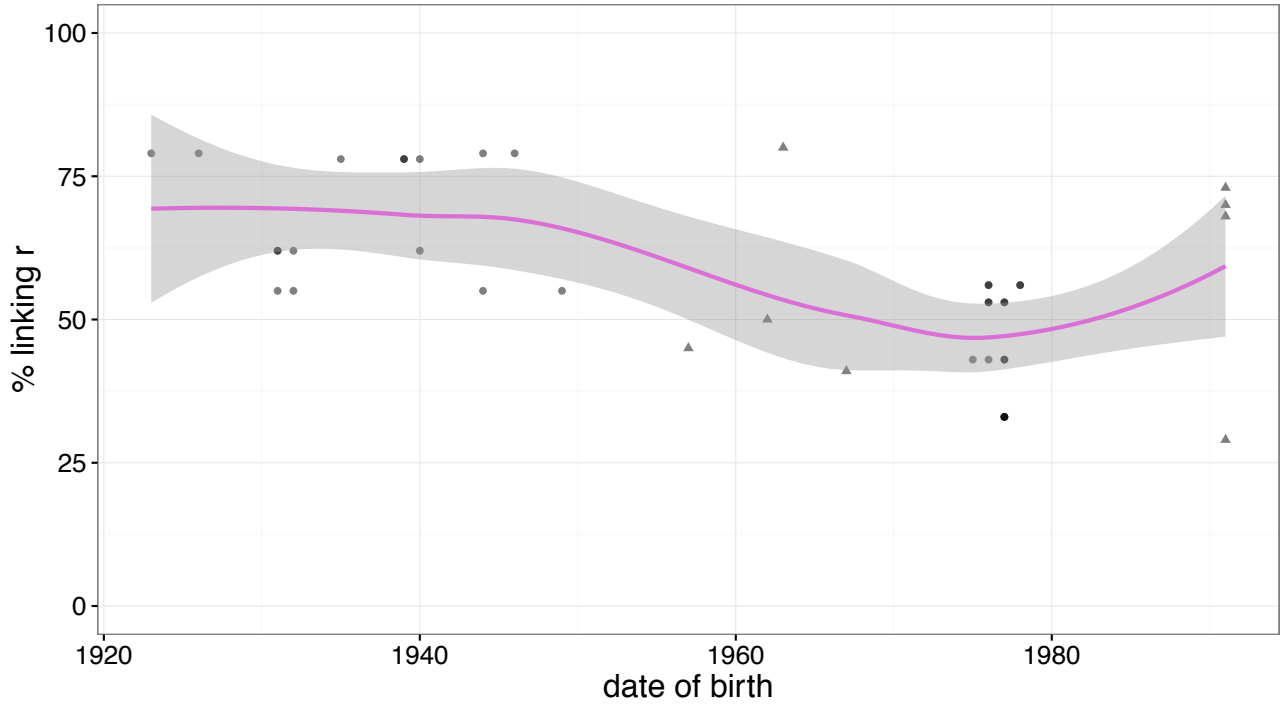

Figure 1: Linking /r/ rates by birth year in Tyneside. Circles represent Foulkes's (1997) data, triangles new data from the present study, showing the reversal of the trend by most speakers born in the 1990s.

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Regional variation in 'Panjabi English': the realisation of /r/ in two English contact varieties

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This paper reports the results of an auditory and acoustic examination of /r/ in two British cities; Bradford and Leicester. In each location, speakers of contact and non-contact varieties were interviewed. Increasingly, research is being undertaken on developing contact varieties of British English (e.g. MLE, Kerswill et al. 2013; Glaswasian, Alam 2015; MME, Drummond 2013). This study is concerned with the contact variety 'Panjabi-English' (PE), i.e. the variety spoken by people with at least one parent who is a native Panjabi speaker from the Panjab region. The non-contact 'Anglo-English' (AE) speakers have two parents who were born and have always lived in the UK.

A combined auditory and acoustic analysis of word-initial (singleton) /r/ (e.g. *reed*,), and word-medial /r/ (e.g. *berry*) was carried out. Identification and characterisation of the post-alveolar approximant [ɹ] is well documented, with numerous authors reporting on expected formant trajectories and protocols for identifying boundaries (e.g. Machač & Skarnitzl 2009; Stevens 2000). In addition to the post-alveolar approximant, there are numerous potential variants associated with /r/, some of these expected (see Figure 1 for an alveolar tap), others more innovative and individual (see Figure 2 for a labial stop). Group patterns were identified and characterised, and more nuanced variations in realisations were examined. The results were visualised and modelled using multinomial logistic regression, with place and manner of articulation considered separately.

Overall, speakers of the contact variety PE exhibit a much greater degree of phonetic variability in their realisations of /r/ compared to non-contact speakers of AE. This is consistent with Trudgill's (2004) predictions about Stage II of new dialect formation, whereby increased linguistic variability is an expected characteristic of the new variety amongst the first generation of speakers born in the new community.

The results also highlight an interesting pattern, with PE speakers in each location differing from one another. This is contrary to research into contact varieties that often observes similar linguistic patterns amongst contact speakers in spite of geographical separation. In this case, Leicester PE speakers favour labiodental and post-alveolar approximants, where Bradford PE speakers mostly use post-alveolar taps and post-alveolar approximants. The results demonstrate how the geographical positioning of contact varieties is crucial if we are to understand their development. In this instance, the divergent regional patterns can be understood by considering realisations of /r/ by AE speakers. I argue that the divergent patterns between PE in Bradford and Leicester may reflect a relationship between the heritage language, Panjabi, and the regional AE variety, both of which contribute to a larger feature pool for PE speakers (Mufwene 2001).

Figures

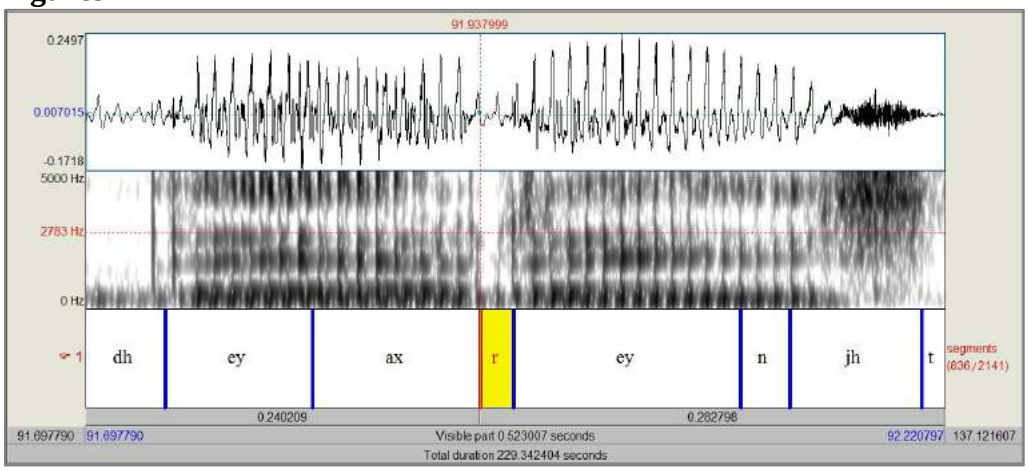

Figure 1: Word-medial alveolar tap in *arranged*. Token from a male Bradford PE speaker

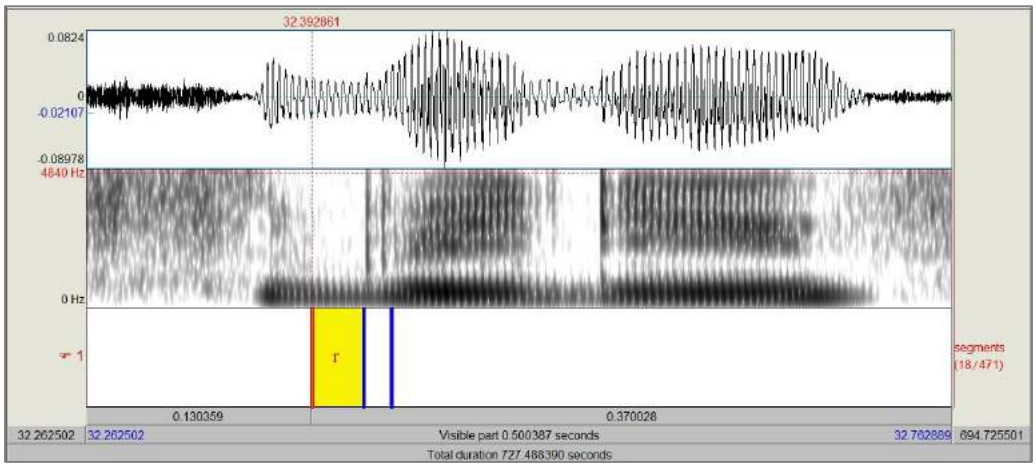

Figure 2: Word-initial stop in *really easy*. Token from a female Leicester PE speaker.

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Phonetic variation among reflexes of murmured plosives in Pakistani Punjabi

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This study attempts to quantify the sound change of voiced aspirated stops (i.e., murmured plosives) among Pakistani Punjabi speakers. Previous studies on Punjabi murmured plosives claim that murmured sounds transphonologize into tones on adjacent vowels (Bhatia 1993, Malik 1995, Yip 2002, Shackle 2003, Bowden 2012). However, only the speech of Indian Punjabi speakers was evaluated. Murmured plosives in Pakistani Punjabi have yet to be presented and quantified.

Acoustic properties of minimally contrastive words were measured from the speech of Pakistani Punjabi speakers in order to provide a more quantified representation of the phonetics contrast. This study found that for the Punjabi variety spoken in Pakistan, the phonetic realization of historical voiced aspirates contradicts earlier findings, and is also inconsistent across speakers.

Table 1 Summary on murmured plosive realization of Pakistani speakers

	Initial σ	Medial σ	Final σ
VOT	DH>D>>>T=TH	D>>DH>>TH>T	D>>DH>>TH>T
Tone	88% No	67% No	57%No

Pakistani Punjabi speakers produce murmured plosive onsets with various VOT values on initial and non-initial syllables. Table 1 shows that Pakistani speakers tend to produce historically voiced aspirated stops as murmured plosives (no historical change), or as voiced unaspirated stops. Murmured plosives becoming voiceless aspirated and unaspirated stops is less common. The tone distinction is not a major cue and is often absent.

The figures below demonstrate the inconsistent murmured plosive realizations of 2 Pakistani Punjabi speakers, on words where the historical voiced aspirate contrast occurs word-initially. Numbers in parentheses indicate the number of tokens with that pronunciation.

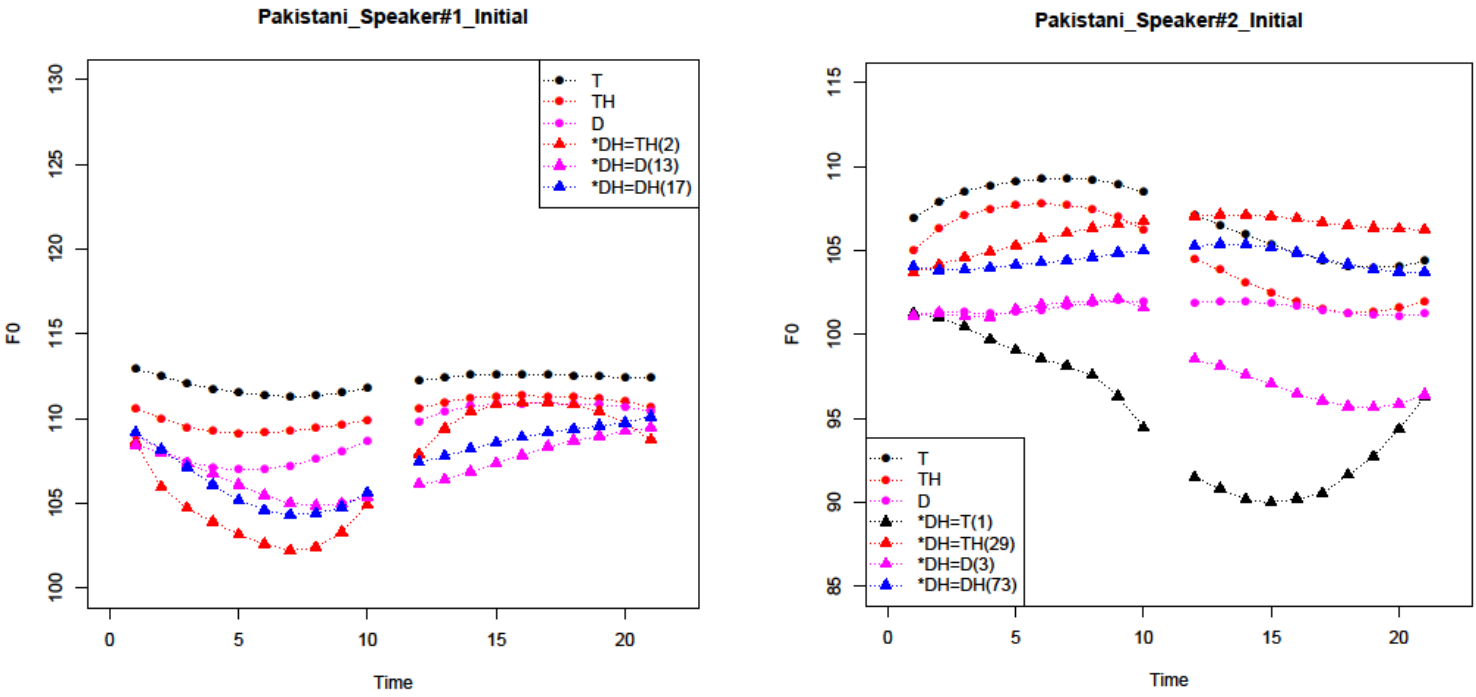

Figure 1 F0 pattern of Pakistani Punjabi speakers

It appears that Punjabi spoken in Pakistan is still in a very early stage of tonogenesis, with variation between and within speakers. Thus, the phonetic cues of historically murmured plosives occur with different degrees of voicing and aspiration across speakers. Although there is some degree of pitch separation, it appears to be redundant with segmental features.