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Using 'stylization queries' to analyze second language learners' intonation production

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Amid the recent explosion of interest in the second language acquisition of intonation, many studies have begun applying Tones and Break Indices (ToBI) and other similar analysis-by-transcription frameworks to analyze L2 learners' intonation. However, dealing with learner data introduces a host of new theoretical and methodological problems. The space of possible category labels must be based around some native-speaker model, either of the L1 or the L2 (assuming both have established prosodic transcription systems). However, an L2 learner's "interlanguage" at any given point in time represents ever-changing mix of characteristics from the L1 and the L2. As such, an analysis drawing on only the transcription category labels from only the L1 or only the L2 would would miss the relevant generalizations. An obvious solution would be to pool the category labels from the L1 and the L2, but this creates rampant analytic ambiguity (since the exact same contour can often be 'parsed' equally well by the two languages). To make matters worse, L2 learners' systems can also develop idiosyncratic features not predicted by either the L1 or the L2 (e.g. due to universal developmental processes), which even a mixed transcription system would fail to account for.

The present paper proposes a new analytical paradigm (stylization queries) as a possible solution to this conundrum. Using the method the documented in Chapter 3 of Albin (2015), the turning points ('vertices') in an F0 contour are identified, either manually or (semi-)automatically, and the shapes of the F0 'transitions' between neighboring vertices are automatically parametrized using a curve-fitting algorithm. Collectively, the information on the vertices and transitions thus stored form a 'stylization' (i.e. quantitative schematic representation) of the original contour. 'Queries' can then be run on the stylizations, extracting phonologically-relevant features of interest for a particular research question based on predictions from the L1 and L2 tonal inventories.

The proposed method is illustrated through a case study of boundary rises in Japanese learners of English as a foreign language. Whereas boundary rises generally begin at the nuclear stressed syllable in English, a boundary rise must begin at the utterance-final syllable in Japanese. To empirically verify whether this discrepancy leads to crosslinguistic transfer, yes/no questions whose final word ends with one or more unstressed syllables, e.g. *Do you know this man in this phó-to-graph?*, were extracted from the English Speech Database Read by Japanese Students (ERJ). The proposed method was applied by creating stylizations of the last two F0 transitions in each utterance (as well as segmenting the final word into individual phones). The stylizations were then queried in various ways, e.g. asking "Among the contours ending with a sequence of a fall followed by a rise, how often did the rise begin within the final syllable?" This statement was true of a substantial portion (approximately half) of the relevant tokens, as predicted under the transfer account.

The case study illustrates how the proposed method enables a researcher to obtain answers to a research question without the need to commit to a phonological analysis of underlying tonal structure on a token by token basis. Queries can be designed to be sensitive to the relevant factors in the L1 and the L2, and any remaining idiosyncratic interlanguage features or analytic ambiguity can be singled out and treated as such. Thus, the present study demonstrates that stylization queries constitute a viable solution to the challenges of analyzing L2 intonation.

Perceptual Deafness as a Consequence of Nonconcatenativeness
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A distinguishing feature of Semitic languages such as Arabic and Hebrew is a nonconcatenative morphological system in which consonants and vowels each have a distinct status (Holes 2002, McCarthy 1981, Watson 2007). The root, which consists of consonants such as /k,t,b/ “writing”, signals the semantic information, whereas vowels get intercalated to signal affix-like morphosyntactic information, such as voice as in /katab “wrote” vs. /kutib/ “was written”, and agentivization as in /kaatib/ “writer”.

Many researchers (cf. Berent & Shimron, 1997; Ravid, 2001, 2002) have argued that the root is the fundamental unit of the mental lexicon, and that listeners give priority to roots over affixes when processing auditory and written words. Arabic presents an interesting example in which roots and affixes are confounded with consonants and vowels, respectively. Accordingly, I hypothesize that Arabic speakers, especially those who have limited or no exposure to foreign languages, will accurately perceive consonants in foreign or nonsense words, but remain insensitive or “deaf” to vowels.

This hypothesis was examined by testing three types of participants: inexperienced Arabic speakers who have limited exposure to English, experienced Arabic speakers who have learned English for over one year, and control English speakers who speak no Semitic languages. The participants were presented with nonsense words that differed in either a single consonant (jabirfugas – zabirfugas) or a single vowel (jabirfugas – jibrifugas), and their task was to judge whether the words were the same or different. The location of the consonant or vowel difference was varied across four possible word positions. An identity-distractor condition was included as a baseline, as was an unrelated-distractor condition. All of the segments used to construct stimuli occur in the inventories of both English and Arabic. The stimuli were recorded by an English-Arabic bilingual talker.

The findings show that Arabic speakers successfully detected consonant change but were deaf to vowel change, regardless of the vowel or consonant position. This effect was greatest for inexperienced participants, and contrasted with results for the English native speakers, who showed balanced performance in both conditions. That is, the Arabic speakers reported more Same responses in the vowel condition while the English speakers reported almost an equal number of same vs. different in both conditions (see Figure 1). This is taken as evidence that the Arabic speakers give perceptual priority to consonants over vowels, and this observation is believed to be a consequence of the nonconcatenative system of Arabic.

![Figure 1: Overall Performance](image-url)
IS TONE IN CHINESE PHONEMIC?

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ABSTRACT

Modern Standard Chinese (Standard Mandarin, henceforth “Chinese”), like many other languages in East and Southeast Asia, is believed to have “phonemic tone” (Sun 2006; Yip 2002: 1; Chen 2000: 16, 19-20; Duanmu 2000: 225; Wang 1994) in addition to the usual phonemic distinctions found in other languages. According to this belief, Chinese words such as nǐ ‘2.SG.PRO.’ are believed to contrast minimally with other words with the same segmental shape and phonemes, but different tones (or suprasegmental “tonemes”), which distinguish their meanings, e.g. nǐ versus nǐ, ní, nì. However, this theory has never been scientifically tested.

Having closely examined the monosyllabic words (as opposed to syllables) in an oral corpus of Chinese (Chui and Lai 2008), I show:

1. In natural conversational speech, in the vast majority of instances each discrete segmentally monosyllabic word has only one assigned tone. It is thus the only word with that segmental shape. For example, according to the morphological identification and glossing of Chui and Lai, the first paragraph of text M009 includes the monosyllabic words nǐ ‘2.SG.PRO.’ (twice); qù ‘go’ (five times); tā ‘3.SG.PRO.’ (three times); gěi ‘give; hùn ‘fool.around’; dào ‘to, until’; wǒ ‘1.SG.PRO.’; shuō ‘say’. But in the entire text there are no occurrences of a word nǐ, or ní, or nì, nor of a word qu, ta, gei, hun, dao, wǒ, or shuo in any other tone. The only words with those segmental shapes are the forms attested in the first paragraph and many times throughout the text, i.e. nǐ, qu, tā, gěi, hùn, dào, wǒ, shuō. Only a single minimal pair in the text differs by tone. There are no examples of longer words that are homonyms, regardless of their tones.

2. By contrast, many examples of semantically, functionally, and etymologically distinct monosyllabic words are segmentally identical and also have the same tone (e.g., shì ‘thing, responsibility’; shì ‘COPULA’; shì ‘try’). Tone therefore does not distinguish these segmentally identical monosyllabic words.

3. Segmental phonemic distinctions are as expected—e.g., bǔ ‘nourish’, lù ‘road’, and kū ‘cry’, which occur in the corpus, are differentiated by the segmental phonemes /b/ [p], /l/ [l], and /k/ [k]—but tone distribution is, in effect, random. What is not random and does distinguish the meaning of words in Chinese is not tone but the morphosyntactic template of Chinese grammar, which governs what each productive morpheme does, where, and what it means, at every level of the grammar.

It is demonstrated that the theory of phonemic tone does not conform to the data. Accordingly, tone is not phonemic in Chinese. This finding explains why dialect speakers who have different tones, and fluent foreign speakers who cannot pronounce the tones correctly, can understand the standard language and also be understood by native speakers. It also explains why spoken Mandarin transcribed without tones is nevertheless perfectly understandable. This study has major implications for our understanding of Asian languages that have tone or other pitch-accent systems.

(488 words)
An acoustic characterization of the /ɲ/-/n+j/ contrast in Buenos Aires Spanish
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Spanish has three nasal phonemes — /m/, /n/, and /ɲ/ — that maintain their contrast in place-of-articulation in syllable-initial position, as in ca[m]a ‘bed’, ca[n]a ‘white hair’ and ca[ɲ]a ‘sugar cane.’ Several authors (Colantoni & Hualde, 2013; Kochetov & Colantoni, 2011; Malmberg, 1950) have reported a tendency in Buenos Aires Spanish (BAS) to merge the palatal nasal, /ɲ/, and the sequence alveolar nasal plus palatal glide, /n+j/, such that uraɾi'o/ˈɾaɾi'o/ ‘uranium’ and huraɾi'o/ˈɾaɾi'o/ ‘unsociable’ are neutralized. Research has found variability in the community. In an EPG study, Kochetov & Colantoni (2011) found that some speakers of BAS maintained the contrast, producing an alveolar nasal and a more typical alveolo-palatal nasal. Other speakers appeared to neutralize the contrast, producing /p/ in two distinct constrictions, alveolar/post-alveolar and palatal, that are not simultaneous. The present study builds on these findings to investigate the alleged merger of /ɲ/ and /n+j/ in BAS by means of acoustic analysis. Previous work has identified four potential acoustic cues to implement the contrast, which are investigated in this study: (1) duration of the nasal segment (for which /ɲ/ is expected to be longer than /n+j/; García & Rodríguez, 1998; Machuca Ayuso, 1991; Massone, 1988), (2) duration of the following vocalic portion (for which compensatory changes to implement the contrast include a longer vocalic portion after /n+j/; Martínez Celdrán & Fernández Planas, 2007), (3) formant contours in the following vocalic portion (for which /ɲ/ is expected to reach the F2 peak earlier than /n+j/; Martínez Celdrán & Fernández Planas, 2007), and (4) formant contours in the vocalic portion preceding the nasal consonant (for which /ɲ/ is expected to show positive slopes; Baker, 2006). For this purpose, the speech of 33 speakers of BAS (15 males, 17 females; divided in four age groups: 15-19, 20-29, 30-45, 45+) was examined.

Participants performed two reading tasks. First, they read three passages (n= 9 tokens). The second task involved reading carrier phrases, embedded with target words, that enhanced the distinctiveness of the speech output by creating the conditions for hyperarticulation (de Jong, 2004). The carrier phrases were comprised of three sets of sentences that diverged in attention to the phonological target: (a) neutral focus (i.e., speakers focus on an item that it is not semantically/phonologically related to the target word; n=36), (b) lexical focus (i.e., speakers contrast the target word with a semantically related word which bears no phonological similarity; n=18), and (c) phonological focus (i.e, speakers contrast the target word with a phonologically similar target; n=36). All target words included /ɲ/ and /n+j/ preceded and followed by /a/, and in unstressed positions. For comparison purposes, target words also include /n/, in the phonetic contexts outlined above. Each production of /n+j/, /n/ and /ɲ/ and their previous and following vocalic portions were extracted and analyzed using Praat (Boersma & Weenink, 2014). Durational measurements were taken in milliseconds, and formant contours were analyzed by means of smoothing-spline analysis of variance (SSANOVA; Wassnik & Koops, 2013). A total of 3115 tokens were analyzed.

Overall, the nasal consonant was longer for /ɲ/ than for /n+j/ and the following vocalic portion was longer for /n+j/ than for /ɲ/. With regard to formant trajectories, /ɲ/ and /n+j/ showed overlapping contours for both the previous and following vocalic portions. However, when the data was examined according to speaker group, production differences became more evident. Specifically, the results indicate production differences between males and females as age increases. For example, males exhibit a greater tendency to produce durational differences between /ɲ/ and /n+j/ than females. Also, as age increases, so do differences in the F1 and F2 domains. Figure 1 compares SSANOVAS of formant contours in the following vocalic portion of 45+ males and females in the phonological condition.

Taken together, the findings indicate that the acoustic measurements under examination may be used to characterize the contrast under study. The results suggest that /ɲ/ and /n+j/ are not fully merged, as some speakers appear to maintain the contrast (in particular, older males). This research is part of a larger project that investigates the reports of neutralization of /ɲ/ and /n+j/ by examining the perception and the production of this contrast by native speakers of BAS. Thus, it explores issues of neutralization, the relationship between production and perception, and the importance of phonetic detail in phonological analysis.
Figure 1 - SSANOVAs of the vocalic portion following /ɲ/, /n+j/ and /n/, for male and female speakers in the 45+ age group, in the phonological condition.

References
Perception of code-switched utterances by early sequential Spanish-English bilinguals

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When bilinguals communicate with one another they are faced with the choice of communicating in one language or engaging in mixed-language use known as “code switching,” operationally defined for this study as the use of two languages within a single utterance or discourse (Gennesse & Nicoladis, 2006). Intra-sentential code switches may occur either as linear shifts from one language to the other as in “Mi nieta quiere su ice cream in a bowl” (“My granddaughter wants her ice cream in a bowl”) or the code switches may alternate one or multiple times during the course of a sentence as in the example “Let’s go to la playa to see las tortugas.” (“Let’s go to the beach to see the turtles.”) The former type of intra-sentential shift will be referred to as a “phrasal” boundary switch (Meisel, 1994) and the latter as an “island” switch (Myers-Scotton, 1997).

While extensive work has been done on the study of code-switching as it relates to phonetic production (e.g., Toribio et al., 2005), much less is known about the ability of bilinguals to phonetically parse and perceive mixed-language utterances. Prior psycholinguistic studies have examined perception of code-switching using gating tasks to identify a code-switched word (Li, 1996) or by measuring the reaction time required to spot an out-of-language stimulus (Soares & Grosjean, 1984). These studies fail to address questions concerning how well semantic information is conveyed to bilinguals across a variety of mixed-language constructions. Additionally, there is still a gap in our knowledge concerning the effect of environmental background noise, such as in a metro station, on perceiving code-switched speech compared with monolingual speech.

This study investigates the perception of code-switched utterances in early sequential Spanish-English bilinguals living in Miami, Florida. To be considered an early bilingual participants must have learned Spanish from birth and started acquiring English no later than kindergarten. These balanced bilinguals report using both (L1) Spanish and (L2) English in their daily lives where English is the language of educational instruction and Spanish is spoken in their home. Thirty participants were presented with monolingual Spanish and English sentences as well as both phrasal and island code-switched sentences in speech-shaped noise at +10 SNR and repeated the utterances. Each sentence contained three common target nouns that were scored. The research questions investigated were: 1) Are phrasal code switches better understood that island code switches? and 2) Does the direction of the code switch (L1→L2 versus L2→L1) significantly affect comprehension?

Preliminary results indicate that phrasal code switches were understood more accurately than island switches. Results further indicate that no significant difference is present in the directionality of L1→L2 versus L2→L1 language shifts; however, L1→L2 constructions are perceived more accurately than L2→L1 in the island shifting condition.
Selected references:


Influence of Pinyin Tone Formats, Pinyin Absence, and Character Orthography on Chinese Tone Perception and Production

Research has shown that several commonly accepted instructional techniques in a language classroom can be ineffective and may impede learning. When teaching L2 Chinese vocabulary, the most conventional way is to present the new character, its English translation, and pinyin. Pinyin is a Romanized alphabet system developed to represent Chinese pronunciation with letters and diacritic tone marks, as exemplified in (1).

(1) 妈 mother: mā (tone 1); 麻 numb: mà (tone 2); 马 horse: mǎ (tone 3); 骂 to scold: mà (tone 4)

For ease of typing, some instructors may substitute diacritics with numbers to indicate tones, such as ma1 for mā. As students’ proficiency progresses, the inclusion of pinyin in vocabulary teaching may be discarded. One purpose of this paper is to address the instructional influence of pinyin tone formats and the removal of pinyin on tone learnability. Another purpose is to examine the priming effect of orthography on tone acquisition. In Chinese, approximately 96% of the characters are compound characters composed of a semantic and phonetic radical. Among them, 26% contain a reliable phonetic radical that hints at pronunciation whereas the others do not, as shown in (2).

(2) a. Reliable phonetic radical, 生 (shēng) to give birth, in the character 牲 (shēng) livestock.
   b. Unreliable phonetic radical, 九 (jiǔ) nine, in the character 仇 (chóu) hatred.

According to Taft and his colleagues (1997, 1999), learners’ activation of radical information can enhance character recognition ability. It is as yet unknown how the presence of a reliable and unreliable phonetic radical would affect tone learning.

28 learners enrolled in Chinese 102, 202, and 302 participated in this study. They all learned 24 unfamiliar words on a computer one after another in six conditions—3 written pronunciation conditions (diacritics/numbers/no pinyin) X 2 phonetic radical conditions (reliable/unreliable). Each condition included 4 characters varying in tones. Before the learning task, the author reviewed the four lexical tones by using the syllable ma. All learners could accurately perceive and produce tones. They also reported not knowing the 24 characters. In the learning phase, each character with or without pinyin and its English translation were shown for 25 seconds. Simultaneously, the participants listened to the pronunciation and were required to read out loud the character. Then they had to demonstrate 90% accuracy on a criterion test, in which they decided whether a character or an English phrase shown on the computer matched the Chinese sound they heard in five seconds. Otherwise, the learning phase was repeated. Following the criterion test was a tone perception task, in which the participants saw characters and the Chinese sounds they heard only involved tone differences. The learners then proceeded to a production task. They saw a character and were given five seconds to read out loud the character. The results show that tone formats and phonetic radicals both significantly affect the participants’ tone perception and production of the target words. The learners perceived and produced tones significantly better when characters were shown with tone diacritics and when the phonetic radical of a character was a reliable pronunciation guide. The presence of pinyin with tone number did not facilitate perception and production more, compared with the condition where pinyin was unavailable. These findings suggest that the inclusion of pinyin with diacritics in vocabulary instruction best facilitates tone acquisition and that learners were sensitive to radical information when it comes to tone learning.
References
Production of English vowel length by Korean L2 learners

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Previous studies of ESL learners illustrate that learners from various language backgrounds do not show English-like patterns in vowel duration differences due to following consonant voicing. A vowel followed by a voiced consonant is consistently longer than that followed by a voiceless consonant in native English productions (Mack, 1982; Flege & Hillenbrand, 1986; de Jong & Zawaydeh, 2002; de Jong, 2004; Mitleb, 1984a). These studies suggest that ESL learners might have transferred the phonetic difference from their L1 while producing English. Complicating the durational effects of voicing, some studies of second language learners demonstrate that those from languages that have no tense/lax distinction have been shown to have problems with the English tense/lax pair, in which part of the phonemic identity has a strong durational component (Bohn & Flege, 1992; Cebrian, 2006; Flege, Bohn and Jang, 1997; Ingram & Park, 1997; Kim, 2010; Klatt, 1976).

This paper investigates how the voicing of the following obstruents and the length of exposure to an L2 English speaking environment affect English vowel durations and formant frequencies. Our aim is to examine whether there is L1 interference on L2 English vowel productions and language acquisition process. Thus, Korean L2 speakers were chosen as participants, who have no coda consonant voicing contrast in a monosyllabic structure nor vowel quantity contrast in their L1 language. Korean does exhibit post-vocalic voicing contrasts in disyllabic structures, and in these cases, phonetically voiced consonants exhibit lengthening of the preceding vowel. In the production task, the participants were asked to read the list of English nonce words in citation form, consisting of the monosyllabic structure /bVC/ and disyllabic structure /bVCa/ with English tense/lax high vowels and sets of plosives contrasting in voicing as a coda for each vowel.

The results indicate that vowel durations in the voiced context were significantly longer than those in the voiceless context not only in the monosyllabic structure but also in the disyllabic structure for all the participant groups (all p’s<.05). As for voicing effect on formant frequencies, F1 preceding voiceless consonant was higher than that preceding voiced consonant whereas F2 showed different patterns depending on backness of the target vowels as well as each group. Regarding vowel quantity distinction, Korean L2 speakers could distinguish tense vowels from lax vowels in terms of duration (tense > lax, all p’s<.05). On the other hand, as for formant frequencies, F1 of lax vowels was significantly higher than that of tense vowels for all the groups (all p’s<.05) in the front vowels whereas they showed different patterns for back vowels depending on each group. F2 value difference in the front vowels was significant only for a Native English group (tense>lax, p<.05) whereas the difference was significant only for the experienced Korean group (lax>tense, p<.05). There was no significant role of the degree of an L2 English experience not only on vowel durations but on the formant values. In conclusion, Korean L2 speakers seemed to have acquired the temporal aspects of English voicing contrast and vowel quantity distinction earlier than spectral properties, which they appeared to have a hard time in using properly due to L1 interference.
Vowel-to-vowel coarticulation is a phonetic process of long-distance assimilation documented for a number of languages, in which the features of one vowel effect change to a vowel in another syllable in a particular direction. Researchers believe coarticulation is diachronically responsible for the emergence of vowel harmony systems (Ohala 1994; Linebaugh 2007; Majors 2006). However, little research has been done on the synchronic interaction of vowel-to-vowel coarticulation and vowel harmony. This study investigates the interaction of palatal coarticulation and palatal harmony in Kazan Tatar, a Turkic language with left-to-right palatal harmony, by analyzing well-established and otherwise phonologically assimilated disharmonic loan words.

A data set of 110 disyllabic Tatar words, each embedded in a carrier phrase, were produced by a native speaker and recorded for acoustic analysis. Harmonic words contained two instances of the same vowel /a/, /i/, or /ä/, while disharmonic words contained each possible sequence of /a/ and /i/ or /a/ and /ä/. Table 1 displays word types as paired for analysis. The values of the second formant, an acoustic correlate of backness, were extracted in Praat at vowel midpoint using a Burg-LPC based algorithm. The effects of right-to-left and left-to-right coarticulation were measured by analyzing first- and second-syllable vowels respectively, and the significance of difference between F2 values in harmonic and disharmonic words was calculated for each pair using a one-way ANOVA.

Significant right-to-left coarticulation was found for all pairs, while no significant left-to-right coarticulation emerged, indicating that coarticulation in Tatar operates only in the opposite direction from harmony. This result echoes those of Beddor and Yavuz (1995) for Turkish and suggests the existence of a cross-linguistic constraint on phonetic and phonological processes with similar modes, domains, and targets of operation.

### Table 1 – Comparison Pairs

<table>
<thead>
<tr>
<th>Anticipatory Coarticulation</th>
<th>Carryover Coarticulation</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. CaCoaC—CaCoaC</td>
<td>D. CaCoäC—CaCoäC</td>
</tr>
<tr>
<td>B. CäCoaC—CäCoaC</td>
<td>E. CäCoäC—CäCoäC</td>
</tr>
<tr>
<td>C. CaCoäC—CaCoaC</td>
<td>F. CiCoaC—CaCoaC</td>
</tr>
</tbody>
</table>

*Underlined vowels analyzed.

### References


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1 This methodology was adapted from Beddor and Yavuz (1995).
Production of English stress by Mandarin-speaking learners
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Stress production and perception among Mandarin-speaking learners of English has been the subject of numerous previous studies (Lin et al. 2013; Zhang, Nissen & Francis 2008). However, many of these studies have largely focused on the surface phonetics, and not on the phonological reasons for these phonetic effects. Theoretical approaches to L2 acquisition and learning have generally involved influence of the L1 grammar on the developing L2 grammar (Flege 2011; Best, McRoberts & Goodell 2001; Kuhl 2000). While prosodic structures are less studied, Archibald (1994) has argued that acquisition of metrical systems can involve transfer of L1 knowledge, notably in terms of stress placement. In this study, the research question is: What do Mandarin speakers transfer to handle English stress? How do they perceive and then categorize the phonetic stress of English? This is explored specifically in terms of how Mandarin speakers realize the phonetic correlates of stress.

Mandarin speakers may transfer Mandarin’s stress system, or they may perceive the F0 cues of English as a tonal contrast. If they transfer Mandarin’s stress system, we should expect L2 stress to be produced similarly to L1 stress, which will rely more on duration and intensity (Duanmu 2000; 2008). In addition, taking the analysis of Chinese developed by Duanmu (2000; 2008), disyllabic words with first syllable or second syllable stress may behave differently, as Mandarin stress assignment rules tend to put stress on the first syllable.

If Mandarin speakers treat English stress categories as Mandarin tonal categories, we should expect higher reliance on F0 and little or no distinction in duration and intensity. In addition, the F0 measurements can indicate whether Mandarin speakers are treating them as a level tone (high vs low) or transferring contour tones from Mandarin. If contour tones are transfers, we should expect the English stress categories to show differences in the location of peak F0 and the range of F0 within the syllable. However, if they are level tones, we should expect just peak F0 and mean syllable F0 to change.

This study examines the production of English by Mandarin speakers with an experimental procedure. Data were collected from 10 Mandarin speakers (5 male, 5 female) and 9 native English speakers (5 male, 4 female). Subjects read a wordlist of 18 disyllabic nouns (9 with initial stress, 9 with final stress) in a carrier phrase. Vowels were isolated and analyzed for intensity, duration, mean F0, peak F0, F0 range, and location of peak F0. Current preliminary results indicate that Mandarin speakers use duration and intensity similarly to English speakers to indicate English stress. Analysis of pitch measurements is ongoing.

Given the results so far, evidence points to the hypothesis that Mandarin speakers are able to transfer their own stress system in order to handle English stress. The fact that Mandarin speakers appear to use duration and intensity similarly to English speakers indicates that Mandarin has similar phonetic correlates of stress to English, and that speakers are able to recognize stress in English and apply appropriate phonetic correlates to it. Conclusions may still change after F0 measurements are completed and validated, as uncertainty about F0 makes it impossible to draw a firm conclusion as to whether tonal categories are transferred.
Production of English stress by Mandarin-speaking learners
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References


The syllabification of an intervocalic consonant in a trochaic sequence in American English (AE) is problematic. For example, speakers (and phonologists) disagree on the syllabification of /t/ in metal. However, if a single intervocalic consonant is before a vowel bearing stress (e.g. /t/ in metallic), there is a clear judgment the consonant comprises the beginning of the stressed syllable (Fallows 1981). This talk proposes that AE has blurred syllabification within the trochaic foot and that this is connected to the importance of foot structure in AE phonology. Phonetic work on AE (e.g. Fougeron and Keating 1997) indicates that foot-initial phonemes are enhanced or demarcated (e.g. by aspiration of voiceless stops) making clear the syllable boundary at the beginning of the foot. Blurred syllabification helps enhance foot-initial demarcation by making foot-internal syllable boundaries less distinct.

Evidence for blurred syllabification comes from schwa syncope (Zwicky 1972; Hooper 1978; Kenstowicz 1994). Consider the words in (a) where schwa syncope (SS) is likely to occur versus (b) where it is unlikely (target schwa is underlined):

(a) chocolate opera family javelin happening camera  
(b) pelican felony parody monitor canopy picketing

The salient observation from Zwicky (1972) and Hooper (1978) is that SS is more likely to occur if the resulting consonant cluster rises in sonority. Hooper (1978) maintains that clusters resulting from SS are ambisyllabic (e.g. the [p] in opera and [m] in family are ambisyllabic after SS). While the data pattern in (a) and (b) seem correct, previous analyses have been unable to explain the pattern. There are many languages (e.g. Korean) that only allow for falling or level sonority over a syllable boundary but none just clusters of rising sonority. The oddity of English SS has never been explained.

I offer a new conception of English SS as foot structure reduction. SS involves reducing dispreferred dactylic sequences into preferred trochaic sequences. That foot reduction is at issue is seen by the fact that SS is unlikely to occur before a stressed syllable; compare òperà (syncope likely) with òperàte (syncope unlikely). The key observation is that SS is dispreferred if the resulting consonant cluster in the trochee has distinct (nonblurred) syllabification. If SS were to occur in (b), (e.g. “fel.ni” for felony) there would be a distinct syllable boundary between the two consonants. SS is favored by the words in (a) where the resulting cluster has rising sonority. But then it is ambiguous or blurred as to where exactly the syllable boundary is in the syncopated forms of (a); where is the syllable boundary in opera and family? Given that SS is optional in reducing a final dactyl into a trochee, one can maintain that there’s an “emergence of the unmarked” effect. From (a) and (b), we observe that AE prefers trochaic sequences where a distinct syllable boundary is avoided. Thus, the notion of blurred syllabification not only explains why SS is favored in (a), but it can also accounts for why speakers have different judgments on the syllabification of trochaic words like metal.
Apportioning Variation: Causes for Variation and Determining the Phonological Space

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This paper begins by presenting the results of a recent study on dialectal variation by myself and Wil Rankinen. In this study, normalization techniques for removing anatomical vocal-tract length effects from vowel formant measures interact with the results of sociophonetic analyses which are supposed to determine potential markers of dialect membership. These results are, of course, of methodological interest, since normalization algorithms are nearly universal in sociophonetic studies. However, more than just of methodological interest, these results raise the more interesting question of whether speaker normalization by human listeners might not actually interact with what acoustic properties are available for dialectal differentiation.

This leads to a hypothesis of the following form: phonetic variation which forms the basis for dialect differentiation, and hence which is likely to be deposited in historical language drift, is specifically that phonetic variation which cannot be attributed to an obvious non-linguistic cause. Or, to state it in the reverse, identifiable causes for phonetic variation actively constrain that variation which can be used for linguistic differentiation. In this talk, I will work out the implications of this hypothesis in two cases.

1) the case of vowel variation and speaker normalization. Here, variation associated with vocal tract length differences is that in which F1 and F2 co-vary, basically, the lower-left to upper-right diagonal axis on the standard vowel chart. This hypothesis predicts that linguistic variation will be deposited disproportionately along the upper-left to lower-right dimension which runs orthogonal to the speaker-normalization dimension. Many well-noted vowel shifts have, in fact, happened specifically in this dimension.

2) the case of F1-undershoot and rate normalization. Here, variation associated with tempo changes is that in which F1 and duration covary. This is expressed in the undershoot function in Linblom (1963). This hypothesis predicts that linguistic variation will be deposited disproportionately in covariation where F1 and duration negatively covary. This negative covariation is a typical effect found associated with the tense-lax distinction. For example, lax [ɪ] is shorter and has a higher F1 than tense [i]. This covariation is also found as an unexplained effect in voicing-induced variation changes in English.
Abstraction in Phonotactic Acquisition: The Role of Frequency and Variability

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Many sequences of speech sounds differ in frequency (e.g., in English, the segment sequence /st/ appears more frequently than /pl/ in word-initial position). Such differences reflect gradient phonotactic constraints, influencing how speakers and listeners learn, process, and recall sound sequences (e.g., Vitevitch & Luce, 1998). When acquiring phonotactic constraints, what sources of information do learners track? Does simple repetition of a segment sequence (token frequency) result in learning? Or do listeners utilize variability, either at the lexical/syllabic level (type frequency) or a phonetically fine-grained level (acoustic variability)? If variability in the input engenders learning, high type frequency and/or acoustic variability should result in learning. More specifically, if learners’ representations of phonotactics include fine-grained phonetic information, high acoustic variability will result in learning, as it does for phonetic category learning (e.g., Logan, Lively, & Pisoni, 1991). If learners’ representations are more abstract, high type frequency will result in learning.

To examine these issues, we used an implicit learning paradigm (Bernard, 2015). Participants heard a series of nonce syllables. After each syllable, they indicated whether or not they heard the syllable previously in the experiment. The distribution of segments in these syllables reflected novel gradient phonotactic constraints, such that a set of segments following one constraint (e.g., “ends in /s/ or /b/”) was presented more ‘frequently’ (in terms of type, token, or number of acoustic contexts) than a set of segments following a different constraint. Participants were also tested on novel syllables, half of which reflected each phonotactic constraint. If participants have learned one of the phonotactic constraints, they should be more likely to incorrectly respond "yes" to novel syllables reflecting that constraint (as these will seem more familiar to participants).

Experiment 1 investigated whether the number of contexts or the number of repetitions was more important for learning. Participants were exposed to conflicting information: a set of syllables reflecting one phonotactic constraint contained only a few unique syllables that were repeated very frequently (high token), while a second set contained a large range of unique syllables repeated infrequently (high type). Participants’ performance suggested they learned the high type pattern: participants responded ‘yes’ to novel syllables with high type frequency segments significantly more than those with high token frequency segments, according to a logistic mixed effects regression ($\beta=5.8$, s.e. $\beta=0.11$, $\chi^2 (1) = 27.23$, $p < 0.001$). This suggests that abstract representations can trigger phonotactic learning. Experiment 2 examined if acoustic variability alone could produce learning. Participants were exposed to contrasting patterns with high vs. low acoustic variability (matched in type and token frequency). No learning occurred: participants did not respond significantly differently to novel syllables reflecting the high vs. low variability sets ($\beta=0.14$, s.e. $\beta=0.15$, $\chi^2 (1) = 0.82$, $p > .05$).

These results suggest that learners utilize variability when learning phonotactic constraints, more so than simple repetition. In addition, this variability is only relevant for learning phonotactics if it occurs at the level of syllabic types, suggesting listeners represent phonotactics at a fairly abstract level.
Chinese NN compounds have a preference for certain length combinations. In particular, 2+2, 2+1, and 1+1 are good, but 1+2 is bad (1 and 2 are syllable counts). An example is shown in (1), where parentheses in the gloss indicate a semantically redundant syllable. The pattern can be explained if NN compounds have left prominence, similar to those in English, such as *pancake*. In the bad form 1+2, main stress falls on a monosyllabic foot, violating Foot Binarity.

(1)  
Length preferences in NN compounds: Left prominence (boldface)

<table>
<thead>
<tr>
<th>Length</th>
<th>Chinese</th>
<th>Gloss</th>
<th>Foot</th>
</tr>
</thead>
<tbody>
<tr>
<td>2+2</td>
<td>mei-tan</td>
<td>shang-dian ‘coal-(charcoal)’ store’</td>
<td>(σσ)(σσ)</td>
</tr>
<tr>
<td>2+1</td>
<td>mei-tan</td>
<td>dian ‘coal-(charcoal)’</td>
<td>(σσ) σ</td>
</tr>
<tr>
<td>1+2</td>
<td>mei</td>
<td>shang-dian ‘coal’</td>
<td>(σ)(σσ)</td>
</tr>
<tr>
<td>1+1</td>
<td>mei</td>
<td>dian ‘coal’</td>
<td>(σσ)</td>
</tr>
</tbody>
</table>

Chinese AN expressions show a very different pattern: 1+1 and 1+2 are quite common, while 2+1 is quite rare. At first sight, the AN pattern suggests right prominence, similar to the case in English, such as *red cars*. The problem is that bare AN structure is in unproductive in Chinese, while [A de N] is fully productive, where de is a particle. This is shown in (2).

(2)  
AN and [A de N] in Chinese

<table>
<thead>
<tr>
<th>Length</th>
<th>AN</th>
<th>[A de N]</th>
<th>Gloss</th>
</tr>
</thead>
<tbody>
<tr>
<td>2+2</td>
<td>?meili</td>
<td>meili de fengjing</td>
<td>‘beautiful view’</td>
</tr>
<tr>
<td>2+1</td>
<td>*meili</td>
<td>meili de ren</td>
<td>‘beautiful person’</td>
</tr>
<tr>
<td>1+2</td>
<td>*gao dongwu</td>
<td>gao de dongwu</td>
<td>‘tall animal’</td>
</tr>
<tr>
<td>1+1</td>
<td>*gao shu</td>
<td>gao de shu</td>
<td>‘tall tree’</td>
</tr>
</tbody>
</table>

We propose that bare AN is not a productive structure in Chinese, while some 1+1 and 1+2 can form a prosodic word whose foot-internal structure is shielded from syntactic constraints. To confirm the proposal, we annotated bare AN in the LCMC corpus, excluding [A de N] and variations of it, including specific contexts where de is subject to deletion (‘hidden de’ contexts). The result is shown in (3), which confirms that our predictions.

(3)  
Occurrences of bare AN in the LCMC corpus (1.5 million graphs)

<table>
<thead>
<tr>
<th>Length</th>
<th>Token</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>1+1</td>
<td>4,361</td>
<td>84.4%</td>
</tr>
<tr>
<td>1+2</td>
<td>622</td>
<td>12.0%</td>
</tr>
<tr>
<td>2+1</td>
<td>76</td>
<td>1.5%</td>
</tr>
<tr>
<td>2+2</td>
<td>107</td>
<td>2.1%</td>
</tr>
<tr>
<td>Total</td>
<td>5,166</td>
<td>100%</td>
</tr>
</tbody>
</table>
In this talk, we provide an overview of essential features of Bukusu tonology, emphasizing phrasal tonal alternations, based on original data.

Bukusu nouns fall into one of four main tonal classes: (i) toneless (e.g. omu-limi ‘farmer’), (ii) H on the augment only (the initial vowel of a noun class prefix complex, e.g. βúu-lo ‘millet’), (iii) H from the augment to the stem-initial mora (e.g. kúmú-βáno ‘knife’), and (iv) one H on the augment and one H on the first mora of the second syllable of the stem (e.g. lii-koongólyo ‘millipede’). There is a set of Ns which properly belong to one of the tone classes with H on the augment, but the augment and its H do not surface in some forms of the Ns. Some Ns have an augment in the plural, but not the singular; in these cases, the covert H is revealed only in the plural forms (e.g. maayi ‘mother’ vs. βá-maaji ‘mothers’, woowáŋi ‘crowned crane’ vs. tʃí-woowáŋi ‘crowned cranes’). Some personal names also have a covert H which appears with a locative prefix such as wá-wamalwa ‘Wamalwa’s place’ vs. wamalwa ‘Wamalwa’. This covert H is a contrastive property, as other Ns which lack the augment do not have an initial H in the plural or locative form, e.g. tʃi-waambuundo ‘bats’ vs. waambuundo ‘bat’, wa-waanj3ala ‘Wanjala’s place’ vs. waanj3ala ‘Wanjala’.

There is a rule which deletes a H from the penultimate vowel of a N in phrase-medial position, generating alternations such as kúmú-βáno ‘knife’ vs. kumu-βano mu-lala ‘one knife’ and lii-koongólyo ‘millipede’ vs. lii-koongólyo li-lala ‘one millipede’. Other Ns do not have alternations in this context, e.g. omu-limi mu-lala ‘one farmer’, βúu-lo βu-lala ‘some millet’, kúmú-tó mu-lala ‘one mattress’ (cf. kúmú-tó ‘mattress’), kúmú-síipi mu-lala ‘one belt’ (cf. kúmú-síipi ‘belt’), éeŋ-gurwé n-dala ‘one pig’ (cf. éeŋ-gurwé ‘pig’).

Another process spreads H from a following adjective onto a N. In underlyingly toneless N, H spreads across the entire N, e.g. kími-βánó kími-βoofu ‘big knives’ (cf. kími-koye ‘ropes’). However, Ns with an underlying H are subject to spreading only onto the final vowel of the noun, e.g. kími-lamaalamá kími-βoofu ‘big trees’ (cf. kími-lamaalamá ‘sp. of tree’). In Ns that have a final H, there is no spreading, and the following H is downstepped, e.g. kími-xuyú ‘kími-βoofu ‘big fig trees’ (cf. kími-xuyú ‘fig trees’). Ns with a penultimate H undergo a processes of plateau, which renders the HØ#H sequence as HH#H (with no downstep), e.g. kími-xuyú ‘kími-βoofu ‘big knives’ and káma-koongójó káma-kali ‘many millipedes’.

Other nominal modifiers trigger a different phrasal rule which inserts a H onto the augment of toneless Ns, e.g. omu-limi yu-no ‘this farmer’, kúmu-koye ku-no ‘this rope’. Ns that underly-ingly bear a H are not affected by this process, e.g. βúu-lo βu-no ‘this millet’, kúmú-βáno ku-no ‘this knife’, lii-koongólyo li-no ‘this millipede’.

Time-permitting, we will discuss aspects of verb tonology. Verbs fall into two lexical tone classes, e.g. xuu-lolelela ‘to watch’, which is toneless, vs. xúu [Botooxana] ‘to go around’, which is realized with an initial H. Verbs bear inflectional tones which reflect tense-aspect-mood-polarity differences and also have phrase-level tonal alternations, showing effects of tone-spreading found in N + Adj combinations, as well as other rules not found in noun phrases.
Word internal consonant clusters are significant parts of Korean phonology, and the consonant alternation caused by it is one of the most significant parts of Korean linguistic study. In this paper, I focus on the case of heterosyllabic consonant cluster, together with the rules supporting the alternation pattern.

The theoretical foundation of this research, which I adopted from the findings by Sohn (1999) and Samuel E. Martin (1954), is presented in the forms of coda neutralization, /h/ aspiration, tensification and sibilation, the specific rules are explained as following:

- **Coda Neutralization:**
  - p, ph, (p’) —> [p]
  - t, th, (t’), s, s’, c, ch, (c’), h —> [t]
  - k, kh, (k’) —> [k]

  
  when unreleased (in the environment of __ C, #, +)

  eg. nach [nat] ‘face’
  iph [ip] ‘leaf’

- **h-aspiration:**
  - lax stop + h —> aspirated stop
  - h + lax stop —> aspirated stop

  eg. coh-ta [co.tha] ‘is good’

- **Tensification:**
  - lax C —> tensed C in the environment of [p,t,k] __

  eg. capci [cap.c’i] ‘magazine’

- **Sibilation:**
  - t —> [s] in the environment of __ s, s’

  eg. k’och-so [k’o(s).s’nj] ‘blossom’

Also, I adopted the theories from Avery & Idsardi (2001) and Charles E. Cairns & Mark H. Feinstein (1982) as sources of phonological support in this paper, connecting them with the four alternation rules above. As sources of the phonological theories, three laws brought up by Avery and Idsardi (2001) are pulled out, those are Kingston’s Law, Vaux’s Law and GW’s bipositional property.

First, according to the theories of Avery and Idsardi (2001), GW must be bipositional in Korean, However, Korean syllable structure only allows single slot in coda position, which means the subsequent position is not available for GW to spread onto, hence GW is not applicable in coda. The assumption that GW as bipositional results in the process of coda neutralization in Korean is defined and discussed for the first time by me, to come up ultimately with an assumption explaining why GW is supposed to be deleted in the coda position in Korean.

Also, Avery & Idsardi raise two theories about the phasing relationship with GW, known as Kingston’s Law and Vaux’s Law (Avery & Idsardi 2001:47):

- **Kingston’s Law:**
  - a. GW in phase with stop —> [constricted]
  - b. GW out of phase with stop —> [spread]

- **Vaux’s Law:**
  - [fricative] —> GW
voicing the initial portion of the vowel, and ultimately completing GW with [spread](Avery & Idsardi 2001:64). And after analysis, it has been found that alternation occur because the combination of the original sounds violate Kingston’s and Vaux’s Law, calling for remedy via sound alternation.

Reference
Final devoicing in Castilian Spanish

It has been claimed that the common phenomenon of word-final obstruent devoicing, as we find in German, Turkish, Catalan and other languages, has its phonetic origin in sound change in the prepausal environment, with analogical generalization to other phrasal contexts (e.g. Hock 1991, Cole & Hualde 2014, among many others). Recently, Myers & Padgett (2015) have provided experimental evidence for this hypothesis, showing that subjects do in fact generalize word-final devoicing from the phrase-final to the phrase-medial context. However, the sequence of postulated intermediate stages in the extension of devoicing from the phrasal to the word level in historical change remains underdocumented. One way to test the hypothesis is by examining languages where final devoicing is an optional phenomenon. In this presentation we will discuss the results of our investigation on the devoicing of final /-d/ in a corpus of Castilian Spanish (Glissando, Garrido et al. 2013). In this Spanish dialect final devoicing is a variable phenomenon. The only common word-final voiced obstruent, /-d/, is variably realized as a voiced approximant or as a voiceless fricative and is also frequently deleted. We will report on the incidence of these distinct realizations depending on the following context. The prediction is that voiced realizations of /-d/ will be most frequent before a voiced consonant or a vowel (e.g. la ciudad es ‘the city is’), whereas the voiceless fricative allophone will be found most commonly before pause. The presence of voiceless realizations of /-d/ before a vowel will be interpreted as evidence of analogical generalization of devoicing. We also explore the role of word frequency and lexical identity in this process.
Multiple repair strategies in adapting English coda [m] into Standard Mandarin loanwords
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This study proposes an analysis in which phonetic cues and phonology interact to account for the adaptation of English coda [m] with vowel epenthesis, adaptation without epenthesis, and when variable adaptation occurs in Standard Mandarin (SM) loanwords. SM speakers have three possible strategies to repair the illicit coda [m] in SM loanwords: place of articulation (POA) alternation ([m] → [n] / [ŋ]), [m] deletion, and vowel epenthesis. We show that SM speakers use different repair strategies based on (i) the degree of phonetic saliency of [m] and its phonological environment in English and (ii) SM-specific phonological preferences, suggesting the integration of both phonetic and phonological factors in the adaptation process.

In two corpora with more than 4500 proper nouns, we identify that vowel epenthesis appears when [m] is in word-medial and word-final coda positions in English (in (1)). However, when English coda [m] is in a homorganic environment such as [m.b] or [m.p], vowel epenthesis never occurs; instead, [m] POA adaptation occurs (in (2)). In addition, when the pre-[m] vowel is long or a diphthong, even in a homorganic environment, [m] is adapted with vowel epenthesis (in (3)). Variable adaptation occurs when [m] is adjacent to non-labial stops (in (4)).

1. Vowel epenthesis: word-medial, word-final coda.
   - Camrose → [kʰə.muː.lə.oː.sː]  
   - Beckham → [pei.kʰə.yə.han.muː]

2. [m] POA: [m] in a homorganic environment.
   - Columbia → [ke.lun.piː.jə] (word-medial coda)  
   - Camp → [kʰə.n.ə.pː] (word-final consonant cluster)

3. Vowel epenthesis: [m] in a homorganic environment when the previous vowel is long.
   - Shaumberg → [səu.muː.pəuf] (diphthong)  
   - Bloomfield → [puː.lə.muː.ʃei.or.tə] (long vowel)

4. Variable adaptation: [m] in non-homorganic environment.
   - Camden → [kʰə.muː.təŋ]~/[kʰə.n.ə.tŋ]  
   - Binghamton → [pin.huː.nə.muː.tŋ]~/[pin.han.tŋ]

We propose that vowel epenthesis after [m] is motivated by SM phonology to fix the illicit coda [m] in SM, and at the same time also improves the perceptual similarity between the inputs and outputs to match the perceived consonant release (cf. Kang 2003, Peperkamp, Vendelin & Nakamura 2008). Since English [m.p] and [m.b] are produced with a gestural overlap, such that there is no audible release for the first stop (Henderson & Repp 1982, Browman & Goldstein 1990), vowel epenthesis never occurs in a homorganic environment when the preceding vowel is not long. However, when the pre-[m] vowel is long or a diphthong, epenthesis still occurs, despite satisfying the homorganic condition. We propose that SM speakers keep the more salient vowel duration to fulfill the µµ-syllable constraint in SM (Duanmu 2007), and the epenthetic vowel after [m] fixes the illicit consonant cluster. Variable adaptations occur due to the weak release or no audible release after the coda consonant in consonant sequences. Depending on the following consonant, coda consonants in English have various degrees of release (Davidson 2011). Hence, when the input is perceived with different degrees of consonant release, the SM loanwords are variably produced in two ways—with or without vowel epenthesis.

This study demonstrates that the seemingly inconsistent multiple repairs of the same consonant in the same syllabic position in the source language can be attributed to the integration of perceptual similarity and the borrowing language’s phonology, providing evidence that loanword adaptation involves perceptual assimilation that maps non-native sounds and structures at the perceptual level as well as speakers’ native phonological knowledge.
In Yu’s (2007) prosodic subcategorization approach to infixation, a Generalized Alignment (GA: McCarthy and Prince 1993) constraint is used to position an infix with respect to its “pivot”, the prosodic category to which the infix appears to be anchored. The basic pattern of Tagalog -um-infixation provides a simple illustration. As (1) indicates, the affix -um- anchors at the right edge of the stem-initial onset. The stem-initial onset is the pivot.

(1) Stem: sulat Infixed form: sumulat, *umsulat, *sulumat, *sulatum  ‘to write’

Prosodic subcategorization accounts for the Tagalog pattern using a constraint like ALIGN(-um-, L, ONS₁, R) to align the left edge of -um- with the right edge of a stem’s initial onset, as in (4).

(2) ALIGN(-um-, L, ONS₁, R): The left edge of every -um- affix corresponds with the right edge of some stem-initial onset.

The use of GA constraints presents two difficulties, however. First, GA constraints in general are capable of producing a well-known pathology, the “Midpoint Pathology”, where one of the aligned categories can seek out the center of a form regardless of the form’s length (Eisner 1997, Hyde 2015). Second, the particular GA constraints employed in the prosodic subcategorization approach are more complex than standard GA constraints in that they almost always require special stipulations about the position of the pivot category. ALIGN(-um-, L, ONS₁, R) does not merely require alignment with some onset, for example, the situation that would be found under the standard formulation, but it requires alignment with a particular onset: the first onset of the base. Without the special stipulation concerning the onset’s position, ALIGN(-um-, L, ONS₁, R) could be satisfied by alignment with any onset and the analysis would fail.

Replacing GA with Relation-Specific Alignment (RSA; Hyde 2012) avoids these problems. RSA constraints do not produce Midpoint Pathology effects (Hyde 2012, 2015), and they can capture prosodic subcategorization effects without a special stipulation concerning the position of the pivot. The facts of Tagalog -um-infixation can be captured by ranking the RSA constraint um-INFIX-DEPTH, (3a), above the RSA constraint ALIGN-um-Right, (3b).

(3) a. um-INFIX-DEPTH: *(ons, -um-, seg) / ons … seg … -um-: ‘Assess a violation mark for every *(cons, um, seg) such that an onset precedes -um- with segment intervening.’
   b. ALIGN-um-Right: *(um, S, stem)/ […]um…segment…]stem: ‘Assess a violation mark for every *(um, seg, stem) such that um- precedes a segment within a stem.’

As (5) demonstrates, um-INFIX-DEPTH determines the pivot category. The affix -um- is one of the aligned categories, and the pivot, onset, is simply the other aligned category. Though um-INFIX-DEPTH restricts the affix to a position near the initial onset, the position of the relevant onset is not stipulated in the constraint. Since the constraint prohibits an onset from preceding the affix with a segment intervening, a candidate only satisfies the constraint when -um- precedes the initial onset, as in (5a), or occurs at its right edge, as in (5b). If -um- occurs any further to the right, as in (5c,d), a segment will intervene between the affix and a preceding onset. The decision to locate -um- immediately after the initial consonant, rather than before it, is made by the second RSA constraint, ALIGN-um-Right. Since the prefix position violates ALIGN-um-Right more than the infix position, the infix position is optimal.

(4) um + sulat ALIGN(-um-, L)
   a. um-sulat *
   b. s-um-sulat !*
   c. sul-um-at !**
   d. sulat-um ***

Using RSA constraints has the advantages of avoiding Midpoint Pathology effects and avoiding special stipulations about the position of the pivot, but it also has the advantage of providing a general, uniform analysis for infixation and seemingly unrelated phenomena such as accent windows. RSA constraints similar to those used to position the -um- affix in (5) have been shown to play a key role in creating trisyllabic accent windows and positioning accents within those windows (Hyde 2012, Hyde 2015).
Information Status and Perception of Prosodic Prominence by Linguistically Naïve Listeners

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In English, the production of prosodic prominence on a given word is influenced by its information status. Previous studies (Calhoun, Nissim, Steedman, & Brenier, 2005; Dipper, Götze, & Skopeteas, 2007; Riester, Lorenz, & Seemann, 2010) investigated the role of information status in the production of prosodic prominence, but very few studies have focused on prominence perception. The present study examines information status in the perception of prosodic prominence in conversational English, as judged by linguistically naïve listeners. Moving beyond the simple given/new dichotomy of many prior studies, we adopt the two-level framework of Baumann & Riester (2012, 2013) and distinguish given/new on the basis of lexical and referential criteria, jointly. We show that graded distinctions along the given/new continuum correspond in part to graded distinctions in the probability that listener will perceive a word as prominent.

We collected prominence judgments for an entire TedTalk and analyzed the subset of words for which referential information status could be assessed (159 words). Information status was annotated using the RefLex scheme (Baumann & Riester, 2012, 2013) with two levels status: referential (given, generic, bridging, unused, cataphor, new) and lexical (given, accessible, new) levels. 35 listeners participated in an experiment using Rapid Prosody Transcription (Cole, Mo, & Hasegawa-Johnson, 2010) to mark prominence while listening to the audio sample in real time. We test two hypotheses: 1) the perception of prosodic prominence will be influenced by the information status of a word at both the referential and lexical levels; 2) the probability of perceived prominence will increase from words that have the highest “given” index to those with the highest “new” index of information status, along the Giveness Hierarchy (Gundel, Hedberg, & Zacharski, 1993). The relationship between perceived prominence and information status was examined by mixed effects logistic model (Bates, Maechler, Bolker, & Walker, 2014).

Preliminary results show that prominence perception is significantly influenced by information status at the referential level but not at the lexical level. The probability of perceived prominence increases from Given to New information status at the referential level although other, intermediary levels of information status (Bridging, Unused) were not found to correspond to parallel, graded distinctions of prominence in the order predicted by the Givenness Hierarchy. This study shows that in agreement with previous research on production, the perception of prosodic prominence is also influenced by the information status of a word at the referential level. A surprising finding is that prominence perception is not affected by information status at the lexical level, as has been shown for German (Baumann & Riester, 2013). Also, this study shows that prominence perception is not fully predictable from the information status of a word. The results partially support Giveness Hierarchy. In addition to information status of a word (i.e., top-down knowledge), other factors such as the presence of specific acoustic prosodic cues of a word (i.e., bottom-up knowledge) could affect the perception of prosodic prominence. This needs to be investigated in a further study.
Strengthening and Weakening in Caribbean French based creoles
Iskra Iskrova

A major difficulty in the analysis of phonological processes in creole languages comes from the variability in the data and the inconsistency of the patterns. However investigation of phonological patterns across varieties based on the same lexifier can help identifying processes that have consistently affected the development of these creoles. This probe in the phonology of creoles uses a comparative approach (similar to Smith 2008) to examine several strengthening and weakening processes found in Atlantic French lexified creoles. The occurrence of these processes appears to be sparse and affecting only limited sets of data in a single variety, but the manifestation of different aspects of the same process across the French creole continuum militates in favor of a common set of processes which have shaped the modern form of French lexified creoles. The poster surveys several instances of strengthening and weakening, which can be subdivided into three categories.

1. **Etymologically driven alternations** are also found in the source language, French. The deletion of final –t in alfabet / alfè 'alphabet' can be linked to language change in French. It is not always clear whether two alternating forms entered the creole, or rather the two variants entered the creole at different times.

2. **Koiné based alternations** are those alternations that can be traced back to dialectal varieties of French which have contributed grammatical features to the Colonial French koiné. For instance, nasalization is also found in Picard.

3. **Creole internal processes** have occurred within the creole. They cannot be directly traced back to the lexifier and seem to have taken place within the creole, at formation or at a later time. Examples constitute some assimilation processes, such as voicing in admosfè < atmosfè, and devoicing in apsan < absan.

This survey provides insights into the formation and development of the phonologies of French creoles. More importantly, the comparative look at what appears as sparse data within separate varieties reveals a homogenous set of phonological patterns found across the French lexified continuum.

References:

**The issue.** Franconian (spoken in parts of Belgium, Germany, and the Netherlands) has a contrast between two tone accents, commonly referred to as Accent 1 and Accent 2. In a nutshell, tone accents allow speakers to differentiate the meanings of words on the basis of diverse pitch contours in stressed syllables. Among tone accent languages (like Lithuanian, Serbo-Croatian, Swedish, etc.), Franconian is ‘special’ because of its rich variety in the tonal realization of the accents. The arguably most spectacular pattern of variation is the so-called ‘Rule Reversal’: as first claimed in Bach (1921), some dialects of Franconian (so-called Rule B) have reversed the tonal melodies in comparison to other dialects (Rule A). This talk presents relevant data from my fieldwork on (Köhnlein 2011 et passim) and proposes a diachronic explanation for the reversal.

**Data.** As the idealized contours in (1) demonstrate, Bach’s observation about the tonal reversal between Rule A (Cologne, Peters 2006) and Rule B (Arzbach, my data, to be discussed in more detail during the talk) holds for declarative intonation but not for interrogative intonation (accented syllable white, post-accent grey-shaded). In declaratives, the pitch contour in Accent 1 falls relatively early in Rule A, but relatively late in Rule B – the contours are reversed, in line with Bach (1921). In interrogatives, however, Accent 1 rises relatively early in Rule A *and* in Rule B – that is, there is no tonal reversal in interrogatives, counter to Bach’s original claim.

(1) Tonal contours in Franconian, phrase-medial position

<table>
<thead>
<tr>
<th>Context</th>
<th>Cologne (Rule A)</th>
<th>Arzbach (Rule B)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Accent 1</td>
<td>Accent 2</td>
</tr>
<tr>
<td>Declarative, non-final</td>
<td><img src="image" alt="Contour" /></td>
<td><img src="image" alt="Contour" /></td>
</tr>
<tr>
<td>Interrogative, non-final</td>
<td><img src="image" alt="Contour" /></td>
<td><img src="image" alt="Contour" /></td>
</tr>
</tbody>
</table>

**Diachrony.** These new data shed light on the typological relation between different dialect areas of Franconian. Following Köhnlein (2013, 2015), I propose that the reversal is the result of independent developments from a common predecessor system with one nuclear pitch accent, rising-falling from the focus syllable onwards. Synchronically, such relic dialects can still be found at the western fringes of the area (e.g. Hasselt, Peters 2008). ‘Aiming’ at stressed syllables with a high initial peak for declaratives, (L)H*L, the reversal between Rule A and Rule B arises from diverse adaptation strategies (essentially leftwards shifts of the original contours in Rule A, initial pitch raising in Rule B). The interrogative contours, however, remained unchanged in the dialects, and are therefore still alike in all dialect areas (and thus non-reversed in Rule B). Notably, this reconstruction is perfectly compatible with the largely neglected scenario by Meyer (1937) for the diachronic typology of tonal accent in Scandinavian.
Germanic Mid Vowels as Complex Segments
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Sounds are traditionally characterized as a set of features which correspond to their physical, articulatory properties. In such an approach, the tongue position of high vowels like [i] and [u] is said to be [high], which is to say near to the roof of the mouth. In low vowels like [æ] and [a], the lingual gesturing must be [low], as the tongue is positioned away from the roof of the mouth. Because it is physically impossible for the tongue to implement an articulation that is simultaneously high and low, feature models that follow SPE conventions conclude that mid vowels like [ɛ] and [ɔ], which involve a lingual position that is intermediate to the high and low vowels, have to be characterized as non-[high] and non-[low].

I depart from this traditional characterization and find instead that mid vowels pattern as segments which are simultaneously [high] and [low]. Evidence for this claim comes from sound changes that tease out the [high] and [low] features associated with a single mid vowel into two separate [high] and [low] elements of sound. For example, Proto-Germanic (PGmc.) *[ɛ] regularly corresponds to Old Norse (ON) [ja] (e.g. PGmc. *bergaz ‘mountain’ > ON bjarg), where [j] is [high] and [a] is [low]. In other cases, a [high] segment and a [low] segment coalesce into a mid vowel. For example, the mid vowels in Old High German hōh ‘high,’ ōra ‘ear,’ and nōt ‘need’ derive from PGmc. *[au], cf. the Gothic cognates hauhs, ausō and nauþs.

While it is not necessarily the case that mid vowels in all languages are [high] and [low], the evidence I examine indicates that this kind of mid vowel structure is well represented in the Germanic languages. Given the impossibility of having a lingual gesture that is both close to and far from the roof of the mouth, the analysis suggests that the [high] and [low] structure of mid vowels in Germanic languages must be learned from the way these sounds are perceived and not from the way they are produced.
How Unifiable are Local and Long-Distance Place Assimilation?
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There is overlap between the typologies of local place assimilation (LPA) and long-distance place assimilation, or consonant harmony (CH), in child phonology (Pater & Werle 2001, 2003). Two implicational universals hold in both domains: (1) if non-coronals are targets of assimilation, coronals are as well and (2) if progressive assimilation occurs, regressive assimilation occurs as well. For example, during one developmental stage of a child acquiring American English, CH parallels LPA in Korean (3, 4) (Pater & Werle 2003).

(3) Trevor’s CH   (4) Korean LPA
a. /dɔg/  [gɔg]  ‘dog’ 1;9 a. /pat-ko/  [pak.ko]  ‘receive and’
b. /kot/  [kot]  ‘coat’ 1;9 b. /paŋ-to/  [paŋ.to]  ‘room as well’
The data in (3a, 4a) demonstrate regressive assimilation targeting coronals. The data in (3b, 4b) demonstrate that neither does regressive assimilation target dorsals nor does progressive assimilation target coronals in either system.

(1) is reducible to independent principles such as Preservation of the Marked (de Lacy 2006). Pater & Werle (2001, 2003) argue that (2) is the result of LPA and CH being triggered by the same set of markedness constraints encoding agreement and directionality. This paper argues that (2) holds superficially; formal differences between the directionality of LPA and CH exist.

The directionality of LPA has been argued to result from the active faithfulness constraints rather than being directly encoded in the agreement constraint (Lamont in press). Regressive assimilation results from Positional Faithfulness (Beckman 1998). CH, on the other hand, presents regressive assimilation that is difficult to derive. For example, the CH of a child acquiring Hebrew presents overwhelming regressive directionality (5) (Bat-El 2009).

(5) SR’s CH
a. /glida/  [dida]  ‘ice cream’ 1;5
b. /panas/  [nanas] ~ [mamas]  ‘torch’ 1;6
c. /ipopotam/  [totam]  ‘hippopotamus’ 1;7

Forms like [dida] (5a) in which the initial dorsal has assimilated to the following coronal indicate the dominance of regressive directionality despite Preservation of the Marked. Note that without coda consonants like the word in (5a), Positional Faithfulness is inactive. Unifying LPA and CH requires an identical markedness constraint that does not encode directionality as well as a way to derive directionality in CH. Forms like (5c) which begin with an underlying vowel suggest that word-initial faithfulness is also inadequate to derive this regressive directionality.

Given the limitations of syllable-initial and word-initial faithfulness, an appeal to a tier-based approach (Heinz et al. 2011, McMullin & Hansson 2014 cf. Goad 1997) seems feasible. However, the constraints responsible are either too weak to derive the typology alone or too powerful and predict pathological languages. If LPA and CH are the same phenomenon, directionality must derive from tier-final faithfulness, thus preferring regressive assimilation. If LPA operates over a C-tier, languages without long-distance assimilation must include vowels in the tier. This presents issues in vowel-final words as well as words whose final consonant is not a member of the targeted cluster. In those languages, Positional Faithfulness is still necessary to derive regressive assimilation. An approach utilizing an edge constraint such as R-ANCHOR suffers from the pathological activity of L-ANCHOR, predicting unattested systems with default progressive directionality (Bakovic & Rose 2014). It therefore seems to be the case that CH must encode directionality in the markedness constraint, formally distinguishing it from LPA.
Bilinguals may show varying patterns of phonetic interaction between their first (L1) and second language (L2) (Flege, et al. 1999). L1 phonetic representations may undergo restructuring or modification because of extensive L2 usage (Flege, 1987), resulting in increasing similarity between L1 and L2 phonetic representations (*convergence*). Alternatively, *divergence* may also arise as speakers work to maintain phonetic contrasts, such that otherwise similar L1 and L2 categories may shift apart (Flege, 1987). These findings have largely been based on research investigating consonants and vowels (segments). In contrast to segments, however, languages differing in suprasegmental properties tend to be classified according to absolute descriptions. For instance, tonal languages are those that use lexical tones for meaning contrasts while non-tonal languages are those that do not, a categorical classification that suggests a fundamental distinction between the two (by contrast, there is no distinction to be made between e.g. *consonantal* and *non-consonantal*, or *obstruent* and *non-obstruent* languages). In this case, it is not clear whether there could be convergence or divergence between e.g. a tonal L1 and a non-tonal L2, as the two languages might represent suprasegmental properties in an entirely different manner. Bilinguals who speak both a tonal and a non-tonal language might represent the two languages in fundamentally different, non-interacting phonetic spaces. In contrast, although rhythmic typology classifies languages in a similarly categorical fashion, e.g. as syllable- or stress-timed, there is evidence of phonetic interaction in syllable timing in speakers who share languages of different types (White & Mattys, 2007). However, it is not clear whether the interaction of rhythm systems obtains in all cases, and evidence related to tonal/non-tonal interactions is scarce.

In this study, we investigated interactions between the suprasegmental (tonal/stress and syllable-/stress-timed) properties of Cantonese and English spoken in Hong Kong. Previous work (Law & Francis, submitted) showed that in this diglossic context, language attitudes and proficiency are important factors in segmental phonetic interactions. By examining how suprasegmental interactions may be modulated by language attitudes and proficiency, we can determine whether the representation of rhythm, lexical tones and stress, overlap, or are completely distinct. If knowledge of Cantonese rhythm or tonality influence English rhythm or stress respectively (or vice versa), then, at least in these speakers, different speech rhythms as well as tone and stress must reside within some common representational space.

Native Cantonese-English bilinguals living in Hong Kong (N=20) produced near homophones in both languages under conditions emphasizing each language on different days. Tonality and speech rhythm were quantified by measuring fundamental frequency (f0) range, f0 slope, and pairwise variability index (PVI) and these values were compared to attitude and proficiency scores elicited in a questionnaire. Participants with higher English proficiency showed convergence in speech rhythm while participants with higher English proficiency and more positive attitudes towards Cantonese showed divergence in tonality. These results provide evidence for a common suprasegmental system for L1 and L2 for both rhythm and tonality, and highlight the contribution of proficiency and attitudinal factors to phonetic variability at the prosodic level in diglossic contexts.
Coda neutralization in Korean induces a wide range of homophony. It thus makes Korean an ideal language of research for whether neutralization is phonetically complete or not. However, only one relatively small-scale study documented that manner neutralization of codas (one of 3 types of coda neutralization in Korean) is phonetically complete in production and perception (Kim & Jongman, 1996). Extending the scope of investigation to all of the three types of coda neutralization (i.e., laryngeal, manner, palatal), we examined acoustic correlates of coda obstruents in both spontaneous and read speech in which orthography was either absent or present. We also investigated whether native Korean listeners were able to identify the underlying coda by making use of acoustic cues either measured or unmeasured in the current study.

The results of the production experiment revealed that neutralized coda pairs with laryngeal contrasts exhibited a significant difference in vowel duration and voicing into closure duration in spontaneous speech but not in read speech. This implies that laryngeal neutralization is influenced by the experimental task and is likely to occur in the more complex and communicative-driven task than in the simpler reading task. For the codas subject to manner or palatal neutralization, we obtained mixed results: some codas with an underlying manner distinction were differentiated by vowel duration or closure duration either in spontaneous or in read speech, whereas others did not display any acoustic differences. The perception data showed that the observed acoustic differences were not perceived by Korean listeners. When presented with words with either completely or incompletely neutralized codas, the listeners were not able to successfully label them with the correct underlying forms. This result suggests that coda obstruents were completely neutralized in perception.

Taken together, the current findings demonstrate that coda neutralization in Korean is not always complete in production, but it is apparently always complete in perception (Dinnsen’s (1985) ‘Type B’ neutralization). We discuss how these data challenge traditional phonological theories of neutralization, and how they might be modeled within exemplar-based theories.
This paper examines the effects of weight-sensitivity on stress placement in Norwegian (Rice 2006, Lunden 2007). More specifically, it explains the discrepancy in weight classification between final and non-final syllables. In Norwegian, stressed syllables must be heavy. In nonfinal position, as illustrated in (1a), any syllable with two moras is considered heavy for stress purposes. In final position, however, as illustrated in (1b), a syllable must have three moras in order to count as heavy.

(1)  
\[\begin{array}{ll}
\text{a. Heavy in nonfinal position:} & \text{kénů'ru, distánse (CVC), épó:ke (CV:)} \\
\text{b. Heavy in final position:} & \text{elefánt (CVCC), tulipá:n (CV:C)}
\end{array}\]

I will argue that the mechanism behind the distinction between heavy syllables in final and nonfinal positions is a moraic nonfinality constraint (Hyde 2003, 2007). NONFINALITY-µ, (2a), prevents a mora-level gridmark from appearing over a prosodic word-final mora.

(2)  
\[\begin{array}{ll}
\text{a. NONFINALITY-µ:} & \text{No mora-level gridmark may appear over a prosodic word-final mora} \\
\text{b. STRESS-TO-WEIGHT:} & \text{No foot-level gridmark may appear over a syllable final mora-level gridmark}
\end{array}\]

In conjunction with STRESS-TO-WEIGHT, (2b), which prevents stress from occurring over a syllable-final mora-level gridmark, NONFINALITY-µ ensures that a final syllable must have at least three moras in order to carry a stress.

As (3) demonstrates, NONFINALITY-µ strips the final mora-level gridmark from prosodic word-final syllables, leaving final bimoraic syllables with a single mora-level gridmark and final trimoraic syllables with two mora-level gridmarks. (3b,d) are excluded because their final mora-level gridmarks violate NONFINALITY-µ. Since STRESS-TO-WEIGHT requires that a syllable contain at least two mora-level gridmarks in order to carry a stress, the final trimoraic syllable in (3a) is still stressable but the final bimoraic syllable in (3c) is not.

As (4) demonstrates, since NONFINALITY-µ has no influence in nonfinal position, it cannot strip the final mora-level gridmark from nonfinal bimoraic syllables. Since nonfinal bimoraic syllables have can still have two mora-level gridmarks, STRESS-TO-WEIGHT allows stress over nonfinal bimoraic syllables.

(3)  
\[\begin{array}{|c|c|c|}
\hline
\text{NF-µ} & \text{S2W} \\
\hline
\text{a.} & \text{x} & \text{!} \\
\text{b.} & \text{x} & \text{!} \\
\text{c.} & \text{x} & \text{!} \\
\text{d.} & \text{x} & \text{!} \\
\hline
\end{array}\]

(4)  
\[\begin{array}{|c|c|c|}
\hline
\text{NF-µ} & \text{S2W} \\
\hline
\text{a.} & \text{x} & \text{!} \\
\text{b.} & \text{x} & \text{!} \\
\text{c.} & \text{x} & \text{!} \\
\hline
\end{array}\]

The most recent work on weight distinctions in final syllables in Norwegian (Lunden 2007) suggests phonetic final lengthening as the reason for the weight distinction. An approach within Optimality Theory using NONFINALITY-µ is a simpler approach that fits within the descriptive framework used to classify other stress systems and does not require a new approach or new criteria to be used.
L1 Phonotactics Also Influence the Identification of L2 Vowels: 
Cantonese Listeners’ Perception of [i]-[ɪ] in English 
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The knowledge of distributional probabilities in the native language (L1) is known to influence the perception of sounds in a second/foreign language (L2). For example, native speakers of Japanese, a language without consonant clusters, were reported to perceive illusory vowels in such clusters [1,2]. Unclear, however, is whether L1 phonotactics can modulate the identification of L2 sounds. This study investigates this issue by examining the influence of the licit vowel-coda combinations in L1 Cantonese on the identification of the vowels [i]-[ɪ] in L2 English. Cantonese and English [i]-[ɪ] have comparable quality and duration, but they occur in different phonotactic environments: In Cantonese, [i] appears before the codas [p] and [t], and [ɪ] appears before the coda [k], whereas in English, [i] and [ɪ] can both occur before the codas [p], [t], and [k].

Cantonese-speaking L2 learners of English (experimental group) and native English listeners (control group) completed a vowel-identification task in which they determined whether English words contained [i] or [ɪ]. In a training phase, participants learned to associate the symbols [i] and [ɪ] with their corresponding vowels in monosyllabic English words that did not contain word-final stops and did not form minimal pairs contrasted by [i] vs. [ɪ] (e.g., give, geese). In a testing phase, listeners identified the vowel [i] or [ɪ] in monosyllabic English words that ended with the coda [p], [t], or [k]. The duration of the vowels in all the stimulus words was neutralized to the mean value of naturally produced [i] and [ɪ].

The effect of L1 phonotactics can surface in one of two forms. If, on the one hand, L1 phonotactics modulate Cantonese listeners’ perception of vowel quality, Cantonese listeners should perceive more [ɪ] before [k] than before [p]-[t], irrespective of the vowel heard. On the other hand, given the neutralization of vowel duration in the stimulus words, if L1 phonotactics instead modulate Cantonese listeners’ perception of vowel duration, Cantonese listeners should show the opposite pattern of responses: When listening to the L1-legal [ip]-[it], where the stimulus [i] is shorter than the expected [i] from natural speech, Cantonese listeners should give more [ɪ] responses than when listening to the L1-illegal [ik]; and when listening to the L1-legal [ik], where the stimulus [ɪ] is longer than the expected [ɪ] from natural speech, Cantonese listeners should give more [i] responses than when listening to the L1-illegal [ip]-[it].

The results showed that Cantonese listeners’ vowel identification was modulated by the vowel-coda phonotactics in their L1: For most listeners, [k] introduced more [i] responses than [p]-[t], and this held true for stimulus words containing [i] and [ɪ] alike. By contrast, native English listeners did not show an effect of coda. These results suggest an effect of L1 phonotactics on Cantonese listeners’ perception of vowel duration, with the coda consonant modulating Cantonese listeners’ expectation of vowel duration.

References
This study proposes a phonological representation of Mandarin tones under Avery and Idsardi distinctive feature system (Avery & Idsardi, 2001). I propose that Mandarin tones can be considered as distinctive features realized on vowels.

Laryngeal features are commonly used to contrast consonants in voicing and aspiration. A number of researches (Halle & Stevens 1971, Hombert 1978, Ladefoged 1983, Kingston & Diehl 1994) have described the interaction between tones and laryngeal features from both phonetic and phonological perspectives. Previous studies (Yip 1989, Duanmu 1990, Bao 1999) have attempted to link tonal features to segmental structure. For example, Duanmu (1990) and Bao (1999) both incorporate [stiff] and [slack] in tone models to capture the relationship between tone and voicing. Bao (1999) proposes a model that separates register and contour, yielding a sequence of tonal features.

I work under A&I (2001) framework, where laryngeal node consists of three dimensions: glottal tension (GT), glottal width (GW), and larynx height (LH). Following A&I (2001), I make the following assumptions: (a) only dimensions are contrastive; (b) each dimension can be specified with one and only one gesture; (c) only contrastive features need to be specified. A model illustrating the relationship between gestures and dimensions is shown in Figure 1.

![Figure 1: Laryngeal setting (Avery&Idsardi, 2001: 42)](image)

I invoke two dimensions - GW and GT - to represent tones in Mandarin, where GW is completed by [constricted], evidenced by creaky voice found in Tone3 in Mandarin (Davison 1991); and GT is completed by [stiff]. I assume that rhyme is the tone-bearing unit in Mandarin. Each TBU has two timing slots, which can be filled with different dimensions. Given that Mandarin has four contrastive tones – Tone1 (level), Tone2 (rising), Tone3 (contour), and Tone4 (falling), I propose the following structures to represent four tones in Mandarin.

1. a. Tone 1 b. Tone 2 c. Tone 3 d. Tone 4

X X X X X X X X X

GT ⊘ GT GW GT GT ⊘

I represent Tone1 with one GT dimension that is shared by two timing slots, as shown in (1a). For Tone1, GT is memorized as being associated with two timing lots; whereas for Tone4, GT is stored as being only associated with the first timing slot - the second timing slot is “zero”, yielding a falling tone. Tone2 is represented as “nothing” in the first timing slot, and GT in the second timing slot, yielding a rising tone. For Tone 3, the first timing slot is filled with GW, which is completed by [constricted] that gives us the lower pitch. The second timing slot is filled with GT, which leads to the higher pitch. The sequence of “GW-GT” gives us the rising part of Tone3.

The representations of tones show that Mandarin tonal features behave like segmental features of vowels, realized by a sequence of laryngeal settings. Similar work by Pham on Vietnamese tones (Pham 2001) shows that laryngeal realism for vowels could be a similarity shared by Asian tones.
Selected References


While lowered f0 measurements following voiced obstruents have been observed in a number of languages, empirical data investigating a phonologized relationship between consonant voicing and tone is less plentiful. In a cross-linguistic overview of consonant-tone interactions in upwards of 25 African and Asian languages, Bradshaw (1999) found that such a relationship does often exist, and that it is solely voiced consonants that participate. The current study presents data from Mina, or Gengbe, a Gbe language spoken in Southern Togo and Benin, in order to add to the existing body of empirical work on the relationship between consonant voicing and tone. Our results align with Bradshaw (1999), indicating a connection between voiced obstruents and low tone in Mina.

Although some empirical phonetic work has been done on Ewe (Maddieson 1993), a closely related Gbe language, Mina remains largely unstudied. Mina exhibits interactions between the tone that is realized on a syllable nucleus and the voicing of a preceding obstruent. Preliminary research suggests that pitch targets are lower after voiced than after voiceless obstruents, but thus far these observations remain anecdotal. The current work presents instrumental acoustic analysis of all Mina vowels preceded by both voiced and voiceless obstruents. By investigating the extent of f0 lowering in these contexts, we aim to demystify the interaction of consonant voicing and tone in Mina.

Data in this study are from a single male native speaker of Mina in his forties. Disyllabic nouns beginning in a single Low tone vowel ([e] or [a]) were recorded in three contexts: in isolation, followed by the Low tone relativizer kè, and followed by the High tone WH-determiner ké. Measures reported include duration—in order to investigate a possible relationship between vowel length and Rising tone—as well as time-normalized f0 measures for all vowels. Time-normalized data are used to compare the effects of voiced and voiceless consonants on the f0 of the following nucleus in all tone and vowel contexts.

The results of this study present a first step into Mina phonetics and indicate that complex consonant-vowel interactions as well as tone context must be systematically investigated in order to fully understand the Mina sound system.

References

Perceived prominence in Russian and Hindi: evidence from an unguided prominence rating task
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Information accessibility and the related notion of perceived prominence can be categorically discretized in production through lexical choices and prominence marking devices, such as prosody, word order, or morphological markers [1]. This work investigates the simultaneous availability of structural (related to word order) and prosodic means of encoding information status and perceived prominence in two free word order languages, Russian and Hindi. SVO is the pragmatically neutral constituent order in Russian [2]. Hindi is a head-final SOV language with an established subject-first preference [3,4]. Word order variability in these languages has been characterized as discourse-motivated and used to achieve topicalization or to encode focus and emphasis [5].

In this study, we offer an empirical test of whether the position of a word in a sentence or phrase, along with its acoustic-prosodic properties and information status, mediate its perceived prominence in an auditory listening task, and in a silent reading task (without acoustic factors). To this end, we use two corpora of published/recorded narratives, specifically, two published Russian narratives read orally by a female Russian speaker and 16 oral narratives produced by different Hindi speakers with hand-labeled phonetic transcripts available through OGI Telephone Speech Corpus [6]. We treat all ex-situ occurrences in the corpora as possible cases of structural prominence. Additionally, words occupying the pre-verbal position and words marked with emphatic morphemes in the Hindi narratives are noted as separate categories of potentially prominent information. The information status of each content word is evaluated based on a simplified version of Bauman and RefLex framework [7]. We use acoustic-prosodic measures of f0 (Hz) max and range, mean intensity (dB), and vowel duration (ms) taken from each syllable of each IS-coded content word as correlates of prosodic prominence for prominence measures obtained from the listening task.

In an unguided prominence rating task (PRT) 20 Hindi speakers and 77 Russian speakers marked words that ‘are the focus of their attention’ in the utterance. Inter-rater agreement coefficients for the PRT translate into fair but highly significant agreement levels (Fleiss’ kappa range = 0.26-.36 (p<.001). Obtained mean prominence scores (values between zero and 1) are used as a quasi-continuous measure of perceived prominence and are modeled separately for each language with generalized linear models.

Results reveal that independently of the modality of presentation, in Russian and Hindi, words identifying discourse-new and in Hindi previously unmentioned referents, are perceived as highly prominent. In the auditory modality, listeners treat the acoustic-prosodic realization of a word as a cue to its discourse status. This is evident from the finding that greater vowel intensity in both languages and f0 range in Russian and f0 maxima in Hindi, reliably influence the perception of a word as prominent. In Russian and Hindi, structural encoding of perceived prominence, via positioning of a word in a sentence or clause, is attended to during discourse comprehension. The ex-situ position effect is particularly apparent in Russian, a language known for focus-fronting and IS-triggered right-edge dislocation. Hindi speakers perceive words located in structurally prominent pre-verbal position as highly prominent.
We find that acoustic-prosodic cues and a structurally ‘strong’ sentence position are attended to during reading or auditory comprehension of discourse. Further work is needed to reveal patterns of co-variation among the cues to prominence in Russian and Hindi, to see whether cues are complementary or additive, or whether each cue type is associated with a specific prominence function.

References:

This paper seeks to motivate a well-known stress system asymmetry through exploration of a perceptual basis for the pattern. It is not uncommon for languages with an otherwise alternating stress pattern to allow two unstressed syllables to occur specifically at the end of the word, resulting in word-final stress lapse (e.g. Finnish, Norwegian).

This correlation is potentially explained by word-level final lengthening (Lindblom (1968), Oller (1973)). While we may assume final lengthening exists to varying degrees across languages, it is specifically in those languages in which duration is a stress cue that it could potentially contribute to the rhythmic pattern of the word. This perceptual motivation for the correlation between duration as a stress cue and final lapse tolerance is supported by perception experiments.

Subjects were native English speakers who took the perception studies through Amazon’s Mechanical Turk through ibex (Drummond 2014). Subjects were excluded who could not correctly identify more than two-thirds of the stimuli that truly alternated in stress. Subjects heard strings of five syllables (synthesized with MBROLA (Dutoit et al. 1996) and concatenated in Praat (Boersma and Weenink 2014)), and responded that the string either alternated in prominence or failed to. (Example strings: BAbBaBaBA, BlnbBlnbibi, BuBuBuBuBuB, where the last string ends in an unstressed, but lengthened, vowel). The graph in (1) shows that when duration was included as a cue to stress, syllable strings with final lengthening (rightmost bar) were very likely to be identified as alternating. A sharply different result was found when duration was not one of the stress cues, as is shown in (2).

The results of the studies thus far indicate that final lengthening can contribute to a word’s rhythmic pattern. However, the fact that penultimate stress is cross-linguistically common suggests that final lengthening does not contribute to clash. This suggests that while final lengthening is a prominence when adjacent to an unstressed syllable, it is not when adjacent to a stressed syllable. In order to test this hypothesis, a followup experiments have been run in which non-alternating strings fail to alternate in prominence because of clashes, rather than because of lapses. Thus, the no-alternating syllable strings would have initial or final clash and the test strings would have a syllable with the appropriate edge-phonetics adjacent to a stressed syllable. The results are currently be analyzed.

The results of this line of work indicate that there is a perceptual motivation for the relatively common tolerance of final stress lapse across languages and indicates that final lengthening can affect the phonological patterns of a language.
Rich Representational Models and Their Predictions

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Numerous studies have found that words which are used more often tend to have shorter spoken durations than words which are used less often (all else being equal) (Bybee (2002), Jurafsky et al. (2001), Gahl et al. (2012), Turnbull (2015), etc). Such effects have been attributed to a consistent phonetic bias applied to stored tokens of speech (e.g., Pierrehumbert 2001, Bybee 2001). In fact, what is known as ‘frequency-based reduction’ is often taken as support for the general class of what are known as ‘exemplar’ models. However, this work will show that the expected prediction only follows under certain parameter values, and is not an emergent property of rich representational structure. Further scrutiny of implemented models reveals that other quasi-intuitive predictions do not necessarily hold, and may even be incompatible (e.g., phonetic detail in perceptual memory actually precluding phonetic detail in production).

Rather than attempting to develop a model sufficient to predict a known outcome, I take a very simple model, and determine which predictions arise from which combination of parameter settings. The model instantiates a single-speaker perception-production loop, where production starts with the selection of a token from the desired category. This token is subjected to temporal reduction at utterance and is then added back to the cloud of perceived, or stored, tokens (see Pierrehumbert (2001)). This loop allows for a cumulative effect of reduction: words reduced two or more times with respect to the length of the original token. More frequent words are more often produced, increasing the chances of multiply reduced tokens (Hooper 1976, Bybee 2002). However, representations of higher-frequency words also contain more tokens over-all, including originally longer, unreduced tokens. Therefore, it is not completely obvious what the prediction is for the behavior of high- with respect to low- frequency words.

In simulations involving a single high- and a single low- frequency word, the outcome is found to vary. For 100 runs of 1000 iterations each: 44 runs resulted in distributions where the mean of one or both words was actually longer than the starting mean; and in 23 of the remaining cases the low-frequency word was shorter with respect to its original mean than the high-frequency word.

In models with rich representational structure, small changes in those representations can have very large ramifications. If frequency is in fact represented as relative number of stored tokens, then one prediction is that that low- and high- frequency categories should eventually equalize in terms of their number of exemplars, and their average duration. This is possible because the behavior of these categories depends strongly on how quickly memory traces decay with respect to the accumulation of new traces. In fact, it must be the case that memory decay is a function of accumulation, such that new experiences of tokens ‘displace’ older tokens – otherwise a long period of time in which no new tokens were heard would lead to loss of word information.

These choices about the finer grained details of representational structure are often ignored, or trivialized as implementational conveniences. But if the correct predictions are only possible under particular parameter values then the risk of inconsistency increases. That is, the parameter values required to make one part of the model work have a greater chance of being different than the parameter values required to make a different part of the model work. If the larger goal is a self-consistent model that covers more than a single phenomenon then this kind of exploration of the modeling space provides an important tool for testing linguistic theory.
Traditional foreign language instruction research has been focused more on certain components of the language such as morphosyntax (VanPatten & Cadierno, 1993) rather than in others. For instance, little attention has been paid to pronunciation (Counselman, 2010; Kissling, 2013) with the exception of corrective phonetics courses (Lappin-Fortin & Rye, 2014). It is the objective of this paper to shed light on the field with an analysis of the processing of explicit teaching of a particular aspect of Catalan (i.e. unstressed vocalic system) through its effect on students’ production. For that matter, students, divided in two groups, from an elementary Catalan course will be participating in this study. Their phonetic knowledge will be assessed with a pre-test and it will be previous to receive formal instruction on this phonemes. After that, the effect of instruction will be measured with an information gap task, an interactionist method, which will allow them to produce language freely. For the analysis, the formants in their productions will be examined. Finally, to check if instruction is effective, two post-tests will be carried out. In sum, the values found in both F1 and F2 in the two vowels studied reveal that those values diminished during the post-test 1 but they increased during post-task 2, showing an acquisition of rule at the level it can be acquired after this tests.
The chain-shift pattern of vowel height harmony in Bengali, in which low and mid vowels in monosyllabic verb stems alternate with mid and high vowels, respectively (æ~e, e~i, ɔ~o, o~u), is reported in the phonological literature and by Bengali linguists to be exceptionless. Experimental evidence, however, indicates that Bengali speakers extend this pattern to nonce verbs only about half the time when low vowels are involved. This evidence raises questions about the productivity of the chain-shift pattern, echoing the results of experimental tests of chain shifts in other languages (e.g., Polish, Taiwanese) in which speakers fail to extend opaque phonological patterns to nonce words. One question we may ask is whether the phenomenon described in the literature as an alternation truly neutralizes the vowel height contrasts in the Bengali language. This research presents instrumental acoustic analysis of Bengali vowels produced by 20 native speakers in real and nonce verbs in order to address this question and gain new insight into both the quality of the vowels produced as a result of harmony in real words and how speakers apply the pattern with nonce verbs.
A VOT study of the acquisition of English stop contrasts by Marathi speakers: the mutual influence of L1 and L2

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The purpose of this study is to investigate how L1 influences L2 pronunciation and whether L2 has any effect on L1 pronunciation. The VOT of English and Marathi utterance-initial stops produced by Marathi speakers, who resided in the US, were measured. In utterance initial position, Marathi has four categories of stops: plain voiced (negative VOT), voiced aspirated (negative VOT and aspiration), plain voiceless (short-lag VOT), and voiceless aspirated (long-lag VOT). On the other hand, English has only two types of stops with aspiration contrast, lenis (short-lag VOT) and fortis (long-lag VOT) in this position. The results of the study are compared to the predictions of the Speech Learning Model of Flege (1992). According to the SLM, Marathi speakers should have native-like pronunciation of English stops, lenis stops (short-lag VOT) and fortis stops (long-lag VOT) because both L2 sounds exist in their L1 sounds inventory.

The participants were divided into groups based on length of residence (LOR). They were asked to read aloud a list of words in Marathi and a list of words in English. The results show that the Marathi speakers in this study produced the English lenis stops with negative VOT, not short-lag VOT. And, they produced the fortis English stops with short-lag VOT, not long-lag VOT. This result does not support the SLM’s hypothesis since the prediction is that Marathi speakers should be able to produce English stops accurately because they will equate the sound in L2 with the closest sound in L1.

The LOR was found to be a significant factor that influences the negative VOT in both L1 and L2 stop production. The longer a Marathi speaker had lived in the US, the shorter their negative VOT values are for English lenis stops and Marathi plain voiced and voiced aspirated stops. This is expected because English does not have prevoicing in utterance initial position. The LOR also significantly affected the positive VOT values: Marathi speakers had longer positive VOT for their English fortis stops and their Marathi plain voiceless stops when they had lived longer in the US. The results of this study confirm the influence of L2 on L1 in the process of second language acquisition.

Keywords: VOT, English stops, Marathi stops, Speech Learning Model (SLM)
Weak Bracketing Approaches to Ternary Stress Patterns
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The Weak Bracketing (Hyde 2002) approach to metrical stress employs several nonstandard structural assumptions (overlapping feet, stressless feet) to produce a reasonably accurate typology of quantity-insensitive binary stress patterns. While Weak Bracketing is reasonably successful in the context of binary stress patterns, it is less so in the context of ternary and unbounded stress patterns, producing only a subset of the attested examples of either type.

This paper explores the consequences of adding constraints that prefer ternary patterns to the Weak Bracketing account. FREQUENCY, (1a), is similar to the familiar *CLASH (Prince 1983) constraint. Where *CLASH requires that two entries on one level of the metrical grid have an intervening entry on the next level lower, FREQUENCY requires an intervening entry on the next level higher. INTERVENTION, (1b), requires that a foot intervene between two stressed syllables.

(1)  

a. FREQUENCY: Two non-adjacent terminal grid entries on the same level x have an intervening entry on level x+1.

b. INTERVENTION: A foot must intervene between stresses.

Tableau (2) shows how FREQUENCY requires that at least one out of every three syllables is stressed. The three stressless positions in (2a) garner a violation. The first and last gridmarks constitute non-adjacent terminal entries on the same level yet they have no intervening entry on the next level higher. In contrast, a violation is avoided when a gridmark occurs above any one of the three lower level entries. (2b) avoids a violation because the non-adjacent terminal entries on level 1 have an intervening entry on level 2. (2c,d) avoid violations because the position of the entry on level 2 ensures that the terminal entries on level 1 are adjacent.

Tableau (3) shows the preferences of INTERVENTION. (2a,b) both garner violations, since all feet contain a stress. (2c,d) avoid violations, since stressed and stressless feet alternate.

(2)  

<table>
<thead>
<tr>
<th></th>
<th>FREQUENCY</th>
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<tr>
<td>a.</td>
<td>... x x x ...</td>
</tr>
<tr>
<td>b.</td>
<td>... x x x ...</td>
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<tr>
<td>c.</td>
<td>... x x x ...</td>
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<tr>
<td>d.</td>
<td>... x x x ...</td>
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(3)  

<table>
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<tr>
<th></th>
<th>INTERVENTION</th>
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<tbody>
<tr>
<td>a.</td>
<td>(óσ)(óσ)(óσ)</td>
</tr>
<tr>
<td>b.</td>
<td>(σ[ó]σ)(σ[ó]σ)</td>
</tr>
<tr>
<td>c.</td>
<td>(ó[σ]σ)(ó[σ]σ)</td>
</tr>
<tr>
<td>d.</td>
<td>(óσ)(óσ)(óσ)</td>
</tr>
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</table>

To determine the effects of adding FREQUENCY and INTERVENTION to the Weak Bracketing framework, candidate patterns were generated using custom software and a typological analysis was performed using OTWorkplace (Prince, Tesar, and Merchant 2015). I will discuss the consequences of adding these constraints to the framework in the following ways:

(4)  

a. Add FREQUENCY only as a violable constraint  
b. Add FREQUENCY and INTERVENTION both as violable constraints  
c. Add FREQUENCY as inviolable and INTERVENTION as a violable constraint

Adding FREQUENCY only as a violable constraint, option (4a), produces a range of ternary patterns constructed from overlapping feet. Under pressure from the existing Weak Bracketing constraints, however, these patterns are constructed with amphibrach configurations, (ó[ó]σ), even in cases where a dactyl, (ó[ó]σ), or anapest, (ó[ó]σ), would be more natural. Adding INTERVENTION as a violable constraint, as well, option (4b), yields dactyl and anapest configurations, as well as amphibrachs, but it also yields quaternary patterns when FREQUENCY is low ranked. Finally, an inviolable FREQUENCY, option (4c), prevents the grammar from producing quaternary patterns while still allowing INTERVENTION to produce the desired dactyl and anapest configurations. Because it prevents stresses from occurring more than two syllables apart, however, nonviolable FREQUENCY also prevents the grammar from producing unbounded patterns.
This research presents the results of a corpus study of phonotactic probabilities in Marathi, an Indic language which contains typologically rare breathy voiced obstruents and sonorants. Prior work regarding phonemic frequencies—as revealed by statistical analyses of the lexicon—have established that languages are rife with gradient phonotactic patterns. Some sounds and sound patterns, though legal, occur very rarely, and speakers are aware of and are influenced by these gradient patterns (Ellis 2002; Frisch, Large, & Pisoni 2000; Gathercole, Frankish, Pickering, & Peaker, 1999; Pitt & McQueen 1998; Storkel 2003; Storkel & Maekawa 2005; Vitevitch & Luce 1998, 1999, 2004). Breathy sonorants are particularly uncommon crosslinguistically, and our major question is this: are they somewhat marginal even in Marathi? Are they underrepresented even in the Marathi lexicon, in other words?

An attempt to answer this question must be informed by access to statistical information about phonemic frequencies in Marathi, but such information does not yet exist. We address this gap by providing analysis of the phonemic frequencies of Marathi as reflected in the 2.2 million-word EMILLE corpus. The corpus, though composed of written rather than spoken data, is the largest existing Marathi corpus and as such provides an important starting point. We find that breathy sounds—both obstruents and sonorants—are somewhat underrepresented overall, the breathy sonorants particularly so. We also find that breathy sounds are more like to be followed by low vowels than high vowels. This supports the observation made in Berkson (2013) that the acoustic cues associated with phonation type contrasts are more robust in low-vowel contexts than in high-vowel contexts.

Ultimately, we contend that developing a more nuanced understanding of the language-internal distribution of Marathi’s typologically rare sounds enhances our attempt to understand crosslinguistic phonological patterns. A sound or pattern which is typologically uncommon but highly frequent in a language where it does occur may lend itself to a different analysis than a sound or pattern which is both crosslinguistically rare and phonotactically under-represented language-internally.

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Some work in phonological theory suggests that syllable structure need not decompose internal constituent structure into Onset and Rime (Pierrehumbert & Nair 1995, Yip 2003). This study provides contradictory evidence from Bai language data. In brief, Onset-Rime sub-syllabic constituency is demonstrated to be a necessary component of the Bai phonological system in four aspects. First, Bai phonemics does not optimize economy without this distinction. Second, the sub-syllabic constituents Onset and Rime are directly referenced in several word-formation processes. Third, pre-nuclear glides do not contribute to rhyming in Bai. Fourth, there is no difference in duration between syllables with a pre-medial glide and syllables without a pre-medial glide.

Most descriptions of Bai (Xu & Zhao 1964[1984], Wiersma 1990, Allen 2004, Zhao 2011, Zhao 2012) are presented in the Initial-Final model of syllable description commonly employed in the Chinese linguistic tradition. This tradition generally distinguishes dental sibilants [ts, tsʰ, s] and palatals [tɕ, tɕʰ, ɕ] as separate Initials. While the Initial-Final model is not necessarily phonemic, these classes of Initials are treated as are contrastive before many simple Finals since there are minimal pairs such as [tsa⁴] ‘debt’ and [tɕa⁴] ‘festival’. In contrast however, Dell 1981 suggests that these series are allophonic; that is, dental sibilants become palatals before [i]. The analysis in Dell 1981 is more economical than the descriptions in the Initial-Final model as fewer consonants are needed to distinguish all contrasts. The analysis presented in the study seeks to explain this alternation through syllable structure and articulator-based features.

Assuming a maximal syllable structure of [[C₉]Onset [VV]Rime] for Bai, the sibilants become palatals through merger of the glide features with the consonant in the Onset. In line with the “Bottle Brush” model of phonemics outlined in Halle, Vaux & Wolfe 2000 and Halle 2005, features making direct reference to articulator gestures are allocated to timing slots. The Onset is allocated a single timing slot and the Rime is allocated two timing slots (as all syllables are heavy in Bai). Furthermore, all features corresponding to vociods (i.e. glides and high vowels in most frameworks) are spread from the Rime into the Onset through “Glide Spreading”. As long as these features are not contradictory with the features allocated to other consonants, it is possible for them to merge to a single time slot; this is formalized as the “No Contour Principle” (Duanmu 1994).

This allophonic pattern and Bai phonotactics still leave room for one question, however. Does syllable structure need both sub-syllabic constituency and timing slots? While the phonemic and phonotactic patterns of Bai can be explained through timing slots and feature spreading, the word-formation processes (including derivation of function words, contraction, and “L-L reduplication”) and rhyming patterns are best understood through sub-syllabic constituency; that is, Onset and Rimes are discrete units which can correspond to morphemes and can also be manipulated in morphophonological processes. The presentation of this work also presents duration data comparing syllables with and without pre-medial glides.
Perceptual category mapping between English and Korean from the perspective of English-speaking learners of Korean

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Park & de Jong (2008) attempted to quantify the perceptual similarity between first language (L1) and second language (L2) sounds from the perspective of native Korean learners of English, and investigated how such information is used in L2 category identification. They showed that the perceptual patterns of some L2 sounds can be successfully predicted by using only L1 categories if the listeners’ goodness rating scores were used to weight the probabilistic mapping from L1 to L2 in the predictions. The current study investigates the L1 category contribution to L2 perception with a different population, English-speaking learners of L2-Korean, adopting the general protocols and approach of Park & de Jong (2008). It also examines whether the amount of L1 category contribution to L2 perception changes during the course of L2 learning.

English-speaking students taking a first semester college course in Korean listened to Korean CV stimuli consisting of /t t’ tʰ s s’/ combined with the vowel /a/. They identified the consonant with both English and Korean labeling and also gave gradient evaluations of the goodness of the English labels to the stimuli on a 9-point Likert scale. The data were collected four times over two semesters: Week 5 or 6, and Week 13 or 14 during each semester. The results of the English labeling task were examined to predict what confusion patterns would be expected if listeners used L1 categories and probabilistically mapped them onto L1 category responses.

Results show that the perceptual patterns of the investigated coronal obstruents can be successfully predicted by the use of only L1 categories, though the accuracies for /s/ and /tʰ/ were higher than predicted. This holds true for all four data collection. The prediction was a little better when the listeners’ goodness rating scores were incorporated to weight the probabilistic mapping from L1 and L2. Nevertheless, the prediction was reasonably successful without such weighting. Along with Park & de Jong’s 2008 study, these results provide quantitative support for a strong, long-lasting influence of L1 categories in the perception of some L2 categories throughout language learning.
Reference
CV Skeletal Units in Korean Morphophonology:
With a Focus on Geminate Representation

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The Underlying Representation (UR) of Korean phonology is problematic in general. For example, the UR of geminate can be equally well explained in terms of moraic representation and skeletal timing units. Cross-linguistically, each representation has its own advantages: for instance, CV units model root mapping of Arabic and handle ghost consonants as in French (Clement & Keyser, 1983). Moraic representations, on the other hand, capture stress patterns effectively and can group heavy CVC syllables and CVCV syllables together (Hayes, 1989). This study tests whether moras or CV skeletal units serve as better URs for morphophonological phenomena in Korean, and argues that skeletal units provide a superior analysis.

This study tests five phenomena in Korean phonology: surface variation in post-obstruent position, sub-compounding, umlaut, general coda-cluster behaviors, and different surface forms of suffix ‘-ki-‘. I will show that only C-slot in CV units can effectively reflect the unique surface form of a post-obstruent geminate with syllable boundaries. Also, sub-compounding processes can be efficiently explained by CV units with a single process of automatic spreading to an underspecified C-slot, while a moraic representation needs two processes of delinking and spreading to account for the same process. Moreover, I’ll demonstrate that only C-slot can explain why umlaut does not occur in the case of geminates. An underspecified C-slot creates distance between a target and a trigger in the UR to block umlauts for geminates, a process which cannot be explained by a moraic representation. Furthermore, coda-cluster behaviors also show strong evidence for C-slot in the UR in Korean. As Korean does not permit coda clusters, a deleted coda always creates a free C-slot allowing for gemination of the following obstruent. Finally, with respect to the coda-cluster behaviors, the different surface forms of suffix ‘-ki-‘ can also be explained by compensatory lengthening in the CV timing tier.

Outside the domain of gemination, additional morphophonological evidence provides support for a CV analysis. As I will demonstrate, these include twin vowel deletion, aspiration, and glide formation in the CV timing tier. Such a natural re-timing process cannot be explained by a moraic representation. All of these processes reveal that only CV units can better represent gemination and re-timing process in Korean in a consistent way.

References


Foreign Accent Perception in Accented Noise

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Foreign accents in speech are commonplace and can have an effect on how speech is perceived. However, the speech signal itself is not wholly responsible for the perception of an accent; factors external to the speakers themselves affect listeners’ perception of foreign accented speech. For example, the relative amount of native speech present in accent rating tasks can affect the perceived strength of accent (Flege & Fletcher, 1992). The intelligibility of speech is also increased when the target sentence is masked with foreign-accented speech compared to native-accented masker speech (Calandruccio et al., 2014). In this study, we turn our focus towards how the perceived foreign accent of a speaker is affected by the degree of accent of simultaneously presented background speech.

Two native English speakers along with 4 native Korean speakers produced English target sentences. A group of native speakers of English rated the degree of foreign accent on a 1 to 9 Likert scale for these sentences presented with three types of multi-talker babble noise with a SNR of 2 dB: native English babble, light Korean-accented English babble, and heavy Korean-accented English babble. In order to make heavy and light accent determinations, we had a separate group of 4 native speakers of English to rate 4 English sentences from a group of 23 native English and native Korean speakers in a quiet condition on a 1 to 9 Likert scale. From this group of speakers we selected the 6 target sentence speakers as well as the other babble speakers. The multi-talker babble noise was semantically coherent English phrases and sentences.

Our results show a tendency for listeners to rate the stimuli presented in more native-rated babble as sounding more native-like than the same utterance presented with less native babble. The data also points to native target speech being more sensitive to a change in the degree of accent in babble than non-native target speech. All taken together, the results suggest a “bleedthrough effect” as a result of pieces of the background babble appearing to be processed along with the target speech, thus affecting the perceived accent. The idea is that, to some degree, accent judgments made about background speech cannot be fully isolated from judgments made about the target speaker. These results bring further insight into both how foreign accents are perceived as well as the processing of speech in multiple speaker environments.
References


Phonology and Orthography at Odds: Evidence from a Russian Word-blending Game
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Recent research shows that speakers are sensitive to the strength with which individual phones are associated (Lee and Goldrick 2008) and that the behavior of literate speakers in word games can be affected by their knowledge of orthography (Ventura et al. 2001). However, phonological generalizations can be at odds with orthographic generalizations. In this study, I use a Russian word game to investigate how speakers reconcile conflicting generalizations about secondary palatalization in consonants. In Russian, secondary palatalization, commonly described as a property of consonants, is reflected in orthography with vowel letters.

Russian has a five vowel system /i e ɑ o u/, and a consonant inventory that contains (mostly) paired hard (velarized or unpalatalized) and soft (palatalized) consonants. Paired consonants exhibit a robust palatalization contrast that triggers vowel allophony. There is also a gradient phonotactic preference for soft consonants to precede front vowels, and a weaker preference for hard consonants to precede back vowels. However, this phonological description is contradicted by Russian orthography: for example [tok] ток ‘current’ and [tʲok] тёк ‘(he) flowed’ use the same initial consonant grapheme, and signal consonant softness with two different vowel graphemes.

To investigate the organization of phonological representations in a case where phonology and orthography differ, I designed a Russian-language word-blending game. Participants (5 native Russian speakers living in central Ohio) heard pairs of CVC nonwords, and in a training phase were taught to blend the onset of the first nonword with the rhyme of the second (e.g. [pʲos dˠup] (stimulus) → [pˠup] (target output)). Training stimuli all followed the phonotactic preferences of Russian. Using a phoneticized corpus of Russian (Daland 2009), word-initial CV sequences were separated into categories of “well-associated” (N=88) and “poorly-associated” (N=69) sequences (Perruchet and Peereman 2004). These were used to create 80 stimuli in 4 conditions: stimulus association strength (good/poor) x target output association strength (good/poor). Error rate and error type were analyzed.

Orthographic effects dominated the results. Where phonology and orthography made different predictions about the target blend, error rates were high (N=148, 76%), and favored blends were consistent with an orthographic strategy. E.g. for the pair [pʲote tʲel] we expected [pʲel] on the basis of contrastive consonant palatalization, but [pʲel] if participants used orthography. At the same time, error rates were higher where the target blend’s CV sequence did not follow the phonotactic preferences of Russian (N=93, 95%), and lower where it did (N=55, 57%). This finding is inconsistent with exclusive use of an orthographic strategy, and suggests that participants relied in part on phonological knowledge of CV association. Where the target blends were consistent with blends predicted by distinctive secondary palatalization and an orthographic strategy (e.g. [pʲos dʷup] → [pˠup]), error rates were low (N=22, 12%) regardless of whether the target blend contained a well- or poorly-associated CV sequence.

These results add to evidence showing that speakers are sensitive to the contingency of sequences of phones. Speakers preferred to produce well-associated CV sequences over poorly-associated ones, so long as the input did not contain poorly-associated CV sequences. The results also show the strength of orthographic effects in literate speakers.
Vowel Devoicing in Lezgi
Speech Rate and Gestural Overlap

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Lezgi, a Nakh-Dagestanian language spoken in Southern Dagestan and Northern Azerbaijan, exhibits a pattern of vowel alternation. Some monosyllabic high-voweled noun roots undergo vowel devoicing when followed by a stress-attracting suffix, while similar disyllabic roots historically have lost high vowels in pretonic position. Some examples of this phenomenon can be seen below.

<table>
<thead>
<tr>
<th>Singular</th>
<th>Plural</th>
<th>Gloss</th>
<th>Historical</th>
<th>Current</th>
<th>Gloss</th>
</tr>
</thead>
<tbody>
<tr>
<td>t’ub</td>
<td>t¹up’år</td>
<td>‘finger’</td>
<td>*jumud</td>
<td>jmūd</td>
<td>‘some’</td>
</tr>
<tr>
<td>kʰitʃ</td>
<td>kʰitʃér</td>
<td>‘dog’</td>
<td>*kʰitab</td>
<td>kʰtáb</td>
<td>‘book’</td>
</tr>
</tbody>
</table>

Previous treatments of this phenomenon (Chitoran & Babaliyeva, 2007; Chitoran & Iskarous 2008) have claimed that this devoicing is due to gestural overlap, and that non-high vowels "are also overlapped, but because they are longer they are not completely hidden." Testing the hypothesis that high vowels are devoiced and mid and low vowels are not devoiced due to gradient gestural timing and not a categorical phenomenon, we collected tokens of this phenomenon from various speech rates in order to manipulate the degree of gestural overlap (Byrd, 1996). We found little evidence of variation, and conclude that vowel devoicing in Lezgi is categorical.

Data for this study were collected from one speaker of Lezgi from Northern Azerbaijan. Stems were of the form C₁VC₂ and plural forms C₁VC₂-ýr, where -ýr is a stress attracting plural suffix that undergoes vowel harmony, C₁ is [P], [T], [K], [Q], [s], [ʃ], or [x], and V is [i], [u], [y], [e], or [a]. Of the possible 35 consonant-vowel combinations, one combination was not found ([Py]), while 8 other pairs lacked a singular or plural form, leaving a total of 60 words, collected 4 times in a carrier sentence per speed condition (slow, normal, fast) for a total of 720 tokens.

Spectral energy measurements were taken of the burst after C₁ as per C&I (2008) and most CV combinations were found to have sufficient evidence of similarity across voiced and voiceless consonants, indicating the presence of voiceless vowels. A generalized linear mixed effects model was run to determine vowel voicing’s relationship with speech rate. Speech rate was found to not significantly affect whether or not a vowel was voiced.

(2) Fixed Effects - glmer(Voicing~Speed+(1|Label), family = binomial)

|             | Estimate | Standard Error | z-value | Pr(>|z|) |
|-------------|----------|----------------|---------|----------|
| (Intercept) | 15.2072  | 2.4078         | 6.316   | 2.69e-10 |
| Normal Speed| -1.1404  | 1.9066         | -0.598  | 0.55     |
| Slow Speed  | -0.9069  | 1.9986         | -0.454  | 0.65     |

This study indicates that vowel devoicing is Lezgi is not a gradient phenomenon but a categorical one. The realization of voicing in this vowels is a contrastive phonetic detail in this environment, despite the fact that few languages exhibit phonological devoicing. (Gordon 1998) It shows the power of paradigmatic relationships (Steriade 2000) to prevent neutralizations of relevant contrasts, such as the vowel of the stem. Additionally, this work draws into question the link between speech rate and degree of gestural overlap. This phenomenon further shows evidence of a morphologically-conditioned phonological process, which is not seen in the historically disyllabic stems.

1Where [P], [T], [K], [Q] stand for any stems beginning with one of three voiceless laryngeal specifications, unaspirated, aspirated or ejective.
False memories for Spanish words with /s/
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Free variation is typically restricted to certain phonemes, and to certain positions. In many dialects of Spanish, for example, the phoneme /s/ is realized as [s] initially (*sopa ‘soup’), but exhibits free variation among [s], [h], and [∅] non-initially before C (*busto ‘chest’) (Lipski 1984). Meanwhile, words without /s/ (*nabo ‘turnip’) are realized with relative consistency. These asymmetries suggest that the lexical representation for /s/ in *sopa differs from that in *busto, and that the representation of /s/ differs from that of other phonemes which do not vary freely.

Researchers disagree as to the nature of such differences (Lahiri & Marslen-Wilson 1991, Goldinger 1997), but they have nevertheless employed similar experimental techniques that focus on activation: the logic is that faster reaction times to a stimulus indicate greater activation of the associated representation (e.g., Sumner & Samuel 2005). We use an alternative technique that focuses on distinctiveness. Here, the logic is that representations are memories: stored elements of spoken words. Previous work shows that people actively construct memories at each retrieval, drawing on events they perceived as well as those they did not (Schacter 1996). While people accurately remember distinctive events – e.g., words that are taboo (*hell), mis-spelled (*dreem), infrequent (*creed), or concrete (*ice) – they falsely remember less distinctive events (Gallo 2010). As a way of investigating how free variation affects representations, we ask: do Spanish listeners create false memories at different rates for words like *sopa, *busto, and *nabo?

We used a list paradigm that reliably gives rise to false memories. For example, after hearing a list such as thread, pin, sewing…, people falsely remember hearing the semantic lure needle (Roediger & McDermott 1985). And, after hearing a list such as bag, rack, book…, people falsely remember hearing the phonological lure back (Sommers & Lewis 1999). We selected Spanish phonological lures, matched for frequency and density, across three conditions: initial /s/ (*sopa), medial /s/ (*busto), and controls without /s/ (*nabo ‘turnip’). For each lure such as *sopa, we constructed a list of nine neighbors, differing in initial C (*ropa ‘clothing’), medial V (*sepa ‘that I know’), and medial C (*soda ‘soda’). A speaker from Puerto Rico recorded each word. She produced [s] for all positions, so that we could compare representations across conditions while holding the acoustic signal constant. Native Spanish-speaking participants (n=28) listened to each list and did a recall task (which taps explicit recollection), typing as many words as they could remember. At the end, they did a recognition task (which taps implicit familiarity), making yes/no judgments as to whether they heard the word previously.

The key result, shaded, is that listeners are more likely to falsely remember any word that contains /s/, compared to a control word that does not. This effect holds for recognition, but disappears in recall, where no differences are significant.

<table>
<thead>
<tr>
<th>Recall task</th>
<th>Mean rates of word recall (SD)</th>
<th>Recognition task</th>
<th>Mean rates of ‘yes’ responses (SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heard</td>
<td>Not heard</td>
<td>Lure</td>
<td>Heard</td>
</tr>
<tr>
<td>Initial /s/</td>
<td>0.43 (0.12)</td>
<td>0.15 (0.11)</td>
<td>0.33 (0.27)</td>
</tr>
<tr>
<td>Medial /s/</td>
<td>0.38 (0.11)</td>
<td>0.18 (0.13)</td>
<td>0.24 (0.27)</td>
</tr>
<tr>
<td>Control</td>
<td>0.41 (0.11)</td>
<td>0.19 (0.10)</td>
<td>0.29 (0.22)</td>
</tr>
</tbody>
</table>

*Mixed-effects model, initial /s/: β=0.19, t=3.00, p <0.05; medial /s/: β=0.14, t=2.22, p <0.05

Thus, Spanish words such as *sopa and *busto are particularly effective lures – giving listeners a false sense of implicit familiarity – compared to words like *nabo. This suggests that the acoustic signal associated with /s/ creates relatively indistinctive representations wherever it occurs. More broadly, it suggests that free variation impacts the manner in which listeners remember words, in ways that go beyond mere activation.
Phonological neutralization is a phenomenon where distinctions in the underlying form are lost in the surface form, as shown in the following example from Korean: accusative forms [načɨl] ‘face’, [najɨl] ‘day’, and [nasɨl] ‘sickle’ all surfacing uniformly as [nat] in their corresponding nominative form, specifically where the coronal obstruent occurs in coda position (Bale et al. 2014). Such pattern in alternations through morphological processes serve as compelling evidence for distinct underlying forms, although this type of evidence is generally unavailable in analytic languages, such as many Southeast Asian languages. Several scholars (e.g., Rhee 2003, Tumtavitikul 1993, Ruangjaroon 2006) describe the onset-coda asymmetry in the inventory of consonants in Southeast Asian languages, including Thai, as involving “coda neutralization” to refer to the loss of certain contrasts in coda position that are available in onset position rather than making any claim about underlying representations.

In this study I argue that there are distinct underlying forms that become neutralized in the surface form at coda position in Thai, and I present evidence for this process of coda neutralization using patterns found in 1) compounds derived from Sanskrit and Pali morphemes 2) loanword adaptations, and 3) orthography. I focus on illustrating two specific processes, the neutralization of coronal obstruents as [t] and coronal sonorants as [n] in coda position, although several other coda neutralization processes can be shown in the same sources of evidence presented here.

First, in examining compounds derived from Sanskrit and Pali loan morphemes we find alternations in the coronal obstruent from [t] in coda position to [tʰ], [t̚], and [s] (shown in examples 1-3 below) when the corresponding coronal obstruent is followed by a vowel in a compound. Similar patterns can be found for coronal sonorants alternating with [n] in coda position and [l] and [r] when followed by a vowel.

1) [rat] ‘state’
   [ratʰasaat] ‘political science’
2) [kit] ‘affair’
   [kitəakam] ‘activity’
3) [rot] ‘taste (flavor)’
   [rosanijom] ‘taste (preference)’

Second, loanword adaptations from English also show these patterns, such as [ten.nit] *tennis*, [kʰoot] *coach*, and [pat.tik] *plastic* for coronal obstruents, and [ep.pɪn] *apple*, [bɪn] *bill*, and [bɔn] *ball* for coronal sonorants (Nacaskul 1979, Kenstowicz & Suchato 2006).

Finally, I show that these coda neutralization processes are reflected in Thai orthography. The letters in the Thai alphabet that represent the various coronal obstruents in syllable-initial position can be used as the coda, but the resulting pronunciation is always [t] in coda position; similar patterns can be found for coronal sonorants, where the letters that represent [l] and [r] in initial position receive the [n] pronunciation in coda position. A further analysis of the Thai orthography reveals several other ways in which underlying forms appear to be encoded in the spelling.
The influence of foreign accent on recognition memory
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The Effortfulness Hypothesis proposes that processing speech in adverse listening conditions (i.e., noise or hearing loss) requires extra effort that comes at a cost to other cognitive processes, such as memory (McCoy et al., 2005). Research has also shown that speech produced in an especially clear speaking style (as opposed to a conversational speaking style) yields improved performance on a recognition memory task (Van Engen et al., 2012). It appears, therefore, that processing degraded speech impedes memory. In this study, we test the hypothesis that listening to foreign-accented speech will also result in impaired memory performance compared to native-accented speech. Participants performed a recognition memory task in which they first heard 40 English sentences: 20 spoken by a native Korean speaker (foreign accented) and 20 by a native speaker of American English. They then heard these same sentences again mixed with 40 new sentences. Participants were asked to indicate whether each sentence was “old” or “new.” We found that recognition memory was significantly better for sentences spoken in a foreign accent than for those spoken in a native English accent. In this case, less clear speech appears to have positive effects on memory. This result suggests that the cognitive demands associated with processing foreign-accented speech differ from those required for processing other forms of “degraded” speech signals (i.e. speech in noise, or hearing loss).
Abstract

Data collected during the first year of child phonological development can be challenging. Processes targeting segments often cannot feasibly describe many child forms in relation to adult forms because the divergence is too great and too varied. This points to a larger theoretical question about the relationship between child and adult phonology and how to account for early child language. While rule- and constraint-based theories offer the most widely accepted possibilities, there is growing evidence for usage-based approaches to account not only for the relationship between child and adult forms but also for the important interrelationship between an individual child's words. Research pointing to the reality of whole-word patterns as the primary units of phonological acquisition (e.g., Ferguson & Farwell, 1975; Macken, 1979; Menn, 1971; Waterson, 1971) has developed into a templatic approach to phonological representation, which has been detailed in Vihman and Croft (2007) and pursued by others (e.g., Khattab & Al-Tamimi, 2013; Vihman & Vihman, 2011; Wauquier & Yamaguchi, 2013).

Templatic analysis requires the in-depth longitudinal study of individual children. To test the generalizability of templatic findings, it is necessary to increase the availability of longitudinal data and subject it to templatic analysis. To this end, I present data from a diary study, following one monolingual child learning American English from 12 months of age, when the child began producing words, through 16 months; data collection is ongoing. Analysis has revealed clear patterns (e.g., labial-velar and nasal labial-alveolar consonant patterns, high-low vowel pattern, consonant harmony) and relationships between templates in use and changes in syllable patterns, consonant inventory, lexicon size, and accuracy rates. Templatic analysis offers a convincing account of the earliest forms in my data. As the child’s phonological system develops, however, some forms can be accounted for by processes targeting segments, which may indicate phonological reorganization and the emergence of segments from whole-word patterns as units of phonological knowledge.

References
Initial explorations of a new real-time corpus of a standard dialect:
Acoustic vowel quality in Standard Scottish English in Glasgow

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Real-time studies of sound change in progress, while on the rise, still remain less common than apparent-time studies. Similarly, socio-phoneticians (and sociolinguists more generally) have tended to focus their attention on vernacular varieties rather than standard varieties. Thus, comparatively little is known about stability and/or change in standard varieties, notably even during the 20th century, a period for which detailed phonetic investigation of audio recordings has become possible (but cf., e.g., Harrington 2007; Hernández-Campoy & Jiménez-Cano 2003; Thøgersen & Pharao 2013; Van de Velde et al 1997). While popular assumptions ---and, indeed, expectations--- of standard varieties is that they are stable, empirical evidence is lacking on the extent to which this is actually reflected in fine-grained phonetic variation over time and on the potential influence of other varieties, whether they be related vernaculars or other neighboring standards. This paper addresses these gaps by reporting the very first results from a new real-time research project on phonological variation and change in one particular regional standard: Standard Scottish English (SSE) as spoken in Glasgow throughout the 20th century.

SSE not only exists alongside other standard varieties of British English, such as Received Pronunciation (RP) and Standard Southern British English (SSBE), but it also forms part of the Scottish English continuum with vernacular varieties such as Glasgow vernacular. Some vowels in both SSBE and Glaswegian, e.g. GOOSE~BOOT, are known to have changed quality over the course of the past century, albeit differently in the respective varieties (e.g. Harrington 2007, Scobbie et al 2012). SSE speakers have also been observed to shift from monophthongal to diphthongal pronunciations of MATE and COAT (Johnston 1997). Our analysis uses LaBB-CAT software (Fromont & Hay 2012) to implement recent technical and methodological advances not only in the forced alignment of orthographic and phonemic transcriptions with digitized audio files but also in the automatic extraction and measurement of vowel tokens. We exploit these procedures to determine the acoustic quality of the MEET, MATE, CAT, COT, COAT, and BOOT vowels in a real-time trend sample of adolescent and adult male speakers recorded in one or the other of two time periods (1970s, 1990s). The data thus spans an effective time period of approximately 70 years and enables us to consider diachronic developments for each vowel as well as the systemic relationships among them. Furthermore, we can consider any changes, or the lack thereof, in the larger context of other relevant varieties, such as SSBE and Glasgow vernacular.

Existing research on listening effort has examined the challenges of processing speech when the speech signal is degraded by noise or hearing loss. Such acoustic degradation produces speech signals that deviate from listeners’ stored phonological and lexical representations. As a result, listeners must recruit additional cognitive resources to resolve mismatches between the degraded signal and their long-term representations. This increase in cognitive demand can negatively affect listeners’ ability to encode information in the signal for later retrieval, even when speech is intelligible.

Unfamiliar accents, like acoustic degradation, result in speech signals that diverge from listeners’ long-term representations, yet current research has generally overlooked the relationship between listening effort and accented speech. This study widens the scope of listening effort research to examine the processing of highly intelligible foreign-accented speech. A running memory task (McCoy et al., 2005) was used to investigate the effect of foreign accent on young adults’ ability to recall intelligible spoken words. Results from this initial task show that young adults recall foreign-accented words just as well as native-accented words. However, preliminary data suggest that they are better at recalling native-accented words than foreign-accented words when the inter-stimulus interval (ISI) is shorter. These findings suggest a role for additional cognitive resources in processing accented speech, even when such speech is highly intelligible.
Prosodically-Conditioned Tonal Reduction in Ei Disyllabic Sequences  
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Based on the results of a multi-speaker acoustic study of tone sandhi in the Ei language (Rongshui, Guangxi Province, China), this paper proposes a prosody-based analysis in which (i) the tone of the prosodic head is retained, and (ii) the tone of the non-head syllable is reduced to surface with a low-register tone of variable and gradient pitch values. Those tones that do not undergo the tone sandhi process are proposed to be constrained by phonetic and/or phonological factors.

The acoustic study, the first such study of Ei tones, examined both monosyllabic tones and disyllabic tonal combinations and each item has 10 samples. Four native Ei speakers, older than 65 when the experiments were conducted, took part in the experiments. All acoustic analyses were conducted in Praat. The F0 at every 10% of the rhyme duration was extracted, giving eleven F0 measurements for each syllable.

The results show that there are 7 lexical tones in Ei: Tone1 (52=H-hl), Tone2 (31=L-hl), Tone3 (55=H-hh), Tone4 (34=H-lh), Tone5 (24=L-lh), Tone6 (54=H-hh) and Tone7 (24=L-lh), the last two of which are checked tones with a stop syllable coda. (H and L = high and low registers respectively, and h and l = high and low tonal values respectively.) In disyllabic combinations, the second syllable remains unchanged and the first syllable with T1, T2, T5 or T7 surfaces with a low-register tone. T3 and T6 remain unchanged in front of any tone, and T4 remains unchanged when followed by any tone other than T4 and becomes a level tone 33 before another T4.

The general patterns suggest that Ei tone sandhi is prosodically conditioned. We propose that (i) the disyllabic sequence constitutes a right-headed prosodic domain in Ei, (ii) the prosodic head retains the base tone and the non-head syllable undergoes reduction to be realized as a low-register tone at the phonetic level, and (iii) the sandhi tone does not result from tonal coarticulation or tone spread. The phonetic nature of this tone is supported by the fact that its pitch values are variable, ranging from 33, 32, 21, 22, 23, to 11, 12, and the variation reflects the gradient degree to which the sandhi tone retains some remnant phonetic aspects of the original base tone. Unlike the neutral tone in Beijing Chinese, this variable low-register tone does not have a shorter duration and its phonetic pitch values are not influenced by adjacent tones. This process also differs from the prosodically-based tone sandhi in Wu Chinese since tone deletion in Ei is not followed by tone spread from the prosodic head. We also propose that high-register level and rising tones (i.e. T3, T4, T6) do not undergo tonal deletion/reduction because of perceptual saliency of sustained high pitch, and the T4+T4 sandhi is attributed to dissimilation.

This proposed analysis contributes to the typology of tone sandhi by providing a detailed case study of prosodically-conditioned tonal sandhi. Ei is an understudied and endangered language that has only 5000 speakers, and its tone sandhi has never been examined before, although similar processes exist commonly in those Chinese dialects/languages spoken in Guangxi Province, China.

This paper also discusses implications for several phonetic and phonological issues, including how phonetics and phonology interact in tonal reduction, and whether or not stress plays a role in prosodically-conditioned tonal reduction.
An ultrasound study of the articulatory correlates of vowel anteriority in Kazakh and Kyrgyz
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It is typically assumed that anterior ('front') vowels and posterior ('back') vowels in Turkic languages are distinguished primarily by the position of the tongue body. However, it has been argued based on cineradiography work that the anteriority of vowels in Kazakh is primarily contrasted by retraction of the tongue root.

The present study uses ultrasound imaging to investigate the extent to which the position of the tongue root and the tongue body are involved in the anteriority contrast in Kazakh and Kyrgyz. These two Turkic languages, while closely related, are described as having wildly different phonetic properties of their vowels. A broad goal of this study, then, is to quantify these differences with regard to articulation. More specifically, this study attempts to determine whether there is a difference in the production of vowel anteriority in Kazakh and Kyrgyz that corresponds to the position of the tongue root or the tongue body.

Two native speakers each of Kazakh and Kyrgyz were recorded reading words (in carrier sentences) containing target vowels, which were controlled for adjacent consonants and metrical position. Both ultrasound recordings and audio recordings were made of these sessions. Frames containing productions of the target vowels were extracted from the ultrasound video and the imaged surface of the tongue was manually annotated. Analyses of tongue root and body position were analyzed for each vowel, and will be presented together with formant measurements from the audio recordings.
Phonological substitution errors in L2 ASL sentence comprehension: Negative impact of movement variability

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Second language (L2) learners often have difficulty in perceiving and producing phonological contrasts in their second language (Best & Tyler, 2007; Flege, 1995; MacKain, Best, & Strange, 1981). These findings are often reported for unimodal L2 learners who are acquiring another spoken second language. A growing body of research, however, has begun to explore phonological perception and production of bimodal (M2; second modality) L2 learners of sign languages (Bochner, Christie, Hauser, & Searls, 2011; Morford et al., 2008; Morford & Carlson, 2011; inter alia). The aim of the present study was to explore the phonological errors that M2L2 learners of American Sign Language (ASL) make during ASL sentence processing. By examining phonological substation errors during sentence processing, we were able to capture non-elicited and naturalistic errors in perception. Additionally, it has been shown that the native status of the interlocutor influences the listener’s perception, such that L2 learners often have gains in intelligibility compared to native speakers when listening to other nonnative talkers (interlanguage speech intelligibility benefit, ISIB; Bent & Bradlow, 2003). This same phenomenon may arise for L2 learners of sign language when processing native and nonnative sign production. L2 learners in fact produce nonnative cues when signing, especially in the movement parameter (Cull, 2014; Hilger, Loucks, Quinot-Pozos, & Dye, 2015; McDermid, 2014; Mirus, Rathmann, & Meier, 2001; Pichler, 2011; Rosen, 2004). With emerging support for a hearing dialect, the salient features produced by M2L2 learners could be reinforced through experience with their own productions and could result in differences in perception across signers. Thus, we also investigated whether phonological substitution errors differed across native and M2L2 interlocutors.

Learners (n = 21) saw sentences in ASL that were signed by either a native or M2L2 signer. Learners were to simply translate the sentence from ASL to English. Learners’ responses were analyzed for lexical translation errors that were caused by phonological parameter substitutions (e.g., SUMMER for DRY, a phonological error based on poor location encoding). Unlike previous related studies, tracking phonological substitution errors during sentence translation allows for the characterization of uncontrolled and naturalistic perception errors. Results indicated that learners made mostly movement errors followed by handshape and location errors. Learners made more movement errors for sentences signed by the M2L2 learner relative to those by the native signer. Additionally, high proficiency learners made more handshape errors than low proficiency learners.

Taken together, this pattern of results suggests that late M2L2 learners are poor at perceiving the movement parameter and M2L2 production variability of the movement parameter negatively contributes to perception. Furthermore, the absence of an ISIB effect for M2L2 learners may suggest that the source of the ISIB relies on a shared phonetic-phonological space between the L1 and L2 (as proposed by Bent & Bradlow, 2003). Since spoken and signed languages diverge in their phonetic-phonological realization, it may be impossible for an ISIB to arise. Further studies are needed to better understand the source of movement variability and poor movement encoding in L2 learners of sign language, and how bimodality divergence negatively (or positively) impacts L2 acquisition.
Sign phonetic correlates of movement sonority and handshape markedness modulate L2 ASL acquisition

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Positive transfer of first language characteristics that can facilitate second language (L2) acquisition. However, it is hard to imagine how two phonological systems rooted in disparate sensorimotor systems (i.e., oral-aural vs. manual-visual) could ever begin to interact in significant ways. Instead, perhaps bimodal bilinguals must attune to salient, modality-specific phonetic/phonological features in their sign language, independent of their spoken first language. Multidimensional perceptual salience (i.e., sonority and markedness) of sign phonetic features may aid in L2 acquisition. Sonority in spoken language has a phonetic correlate of amplitude, or loudness, of a given speech sound, which may have representational power within the syllable that can aid in acquisition (Blevins, 1995; Broselow & Finer, 1991; Chin, 1996; Gierut, 1999; Ohala, 1999; Yavas & Gogate, 1999). Sign phonologists agree that movement is the sign phonetic correlate of sonority in a well-formed sign (Brentari, 1998; Corina, 1996; Perlmutter, 1993; Sandler, 1993; Wilbur, 1993). The present study adopts the stance that sonority can be phonetic in nature and thus movement characteristics (e.g., articulating joint, path and hand-internal movements, etc.) are important to the perceptual salience of the sign (see Brentari, 1998; Sandler, 1993). Markedness may provide another source of salience. Handshape, or the configuration of the selected fingers of a sign, can be delineated into a group of marked and unmarked handshapes. Typically, unmarked handshapes are limited to a small group of handshapes (B, A, S, C, O, 1, and 5; Boyes-Braem, 1990), and are typically acquired unmarked handshapes earlier in early acquisition.

It was predicted that the acquisition of signs depends on multiple saliency features. We predicted that signs that contain marked handshapes and high sonority movements increase perceptibility. This prediction is due to marked handshapes being visually distinctive, especially when paired with high sonority movements. Hence, greater perceptibility of the sign will have an additive effect on the phonological specification during acquisition. It is possible, however, that unmarked handshapes with high sonority movements are easier to acquire. Consequently, the roles of motoric and visual complexity were investigated by examining the subsequent production of these signs.

In Experiment 1, L2 ASL learners were taught sign-nonobject correspondences that varied in sign movement sonority and handshape markedness. Results from a sign-picture matching task revealed that high sonority signs were more accurately matched, especially when the sign contained a marked handshape. In Experiment 2, learners produced these familiar signs in addition to novel signs, which differed based on sonority and markedness. Results from a key-release reaction time reproduction task showed that learners tended to produce high sonority signs much more quickly than low sonority signs, especially when the sign contained an unmarked handshape. This effect was only present in familiar signs. Sign production accuracy rates revealed high sonority signs were more accurate than low sonority signs. Similarly signs with unmarked handshapes were produced more accurately than those with marked handshapes. Together, results from Experiment 1 and 2 suggested that signs that contain high sonority movements are more easily processed, both perceptually and productively, and handshape markedness plays a differential role in perception and production. This is one of the first studies to show that, despite modality differences, L2 learners make use of salient phonetic features in both spoken and sign languages during acquisition.