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Chat or Chatter? The role of intonation in vowel insertion

Loan words in Italian with a final consonant in the donor language, such as <chat>, are sometimes pronounced with a final vowel. The insertion of this vowel is probabilistically distributed and dependent on a number of factors. These include speaker-specific preferences, metrical structure and the laryngeal specifications of the consonant. Crucially, a considerable amount of variation is conditioned by intonation: A vowel is more likely to occur — and is acoustically more prominent — if the intonation is complex or rising than if it is falling.

Another language in which vowel insertion is probabilistically distributed is Tashlhiyt Berber, both word finally and word medially. Here too, vowel insertion is dependent on prosodic contexts, with schwa being more likely to surface in positions in which tonal movements are located.

In both of these languages, the insertion of a vowel facilitates the realisation of functionally relevant tonal movements. This points to the considerable role played by intonational tones in determining the structure of the textual material with which they are associated. In this sense, the tune drives the text.
Plenary Talk: Ingo Plag

Beyond morpho-phonology: Phonetic detail and morphological structure

Traditional approaches to the role of sound structure in the description of complex words have usually focused on phonologically conditioned allomorphy or morphologically conditioned segmental or prosodic alternations (such as stress shift, stress preservation, truncation, degemination, or syllabification in English). Such studies have detected interesting generalizations across sets of words but recent empirical studies have found a lot of variation, which calls into question long-cherished ideas about the organization of morpho-phonology. Similarly, the amount of variation observable at the phonetic level has not been looked at systematically, although it has been frequently noted that phonetic reduction may have some relation to morphological complexity. Consider, for example, the word government. It is mostly pronounced [gɑvəmənt] or [gəvəmənt], and this phonological opacity goes together with semantic opacity: government does not primarily denote ‘action of verb’ing’ (as is standardly the case with -ment derivatives), but rather denotes the people who govern, or, more generally, ‘political authorities’. It can thus be argued that government is morphologically less easily segmentable than, say, discernment, where there is no phonetic reduction and full semantic transparency. Empirical investigations in this domain are rare and somewhat inconclusive as to the question whether there are clear correlates of phonetic parameters and morphological structure. This paper will present some recent morphophonetic studies from our lab that shed more light on this issue. Our empirical results challenge fundamental and widely-shared assumptions about morpho-phonology. In this paper we will look at some acoustic properties of allegedly homophonous suffixes and of some derivational affixes. It will be shown that the acoustic properties of complex words may systematically reflect morphological structure. These findings have serious implications for models of phonology-morphology interaction and speech production.
Plenary Talk: Kie Zuraw

The breadth of the candidate set

How broad is the candidate set that the phonological grammar optimizes over? Does the grammar consider multiple pronunciations of the words in the utterance (There are two wug[s] vs. There are two wug[z]), variant constructions with small semantic differences (There are two wugs vs. Two wugs are there), or options with much bigger semantic differences (There are two wugs vs. I can see a couple of little birds)?

This talk aims to contribute to this debate (Martin 2007, Smith 2015, Shih & al. 2015, Bennett & al. 2016, and many others) with data expanded from Zuraw 2015. The earlier study used a written corpus to examine French coordinated structures of the form de X et/ou (de) Y ‘of X and/or (of) Y’, such as de tomates et (de) carottes ‘of tomatoes and (of) carrots’. While that study looked only at the factors that condition omitting the second de, this talk also looks at the order of X and Y, and at which Xs and Ys get coordinated in the first place—concluding that phonological considerations influence choices at a high level.
The phonology of periodicity: Sonority as the perceptual integration of acoustic energies

All languages impose certain restrictions on the organization of speech sounds into syllables. This phonotactic behavior has been traditionally attributed, at least in part, to the notion of sonority. While there have been many attempts to define sonority phonetically (for a thorough overview see Parker 2002), a consistent phonetic correlate has not yet been found.

The current paper suggests that sonority is correlated with the perceptual sensation of pitch (\textit{pitch intelligibility}), acoustically defined as periodic and aperiodic energy in the signal. (Quasi-)periodic energy in speech is the result of phonation (\textit{voicing}) due to vibration of the vocal folds, and it is the main contributor to pitch intelligibility. Aperiodic energy is the result of turbulent airflow, due to constrictions along the vocal tract, and it can be detrimental to pitch intelligibility. Other things being equal, the relative pitch intelligibility values of major segmental categories correlate with standard sonority scales (see Tables 1-2, next page).

Correlations between sonority and periodic energy have been suggested in the past, with prominent examples including Lass (1984), Ladefoged (1997) and Heselwood (1998), going back even to the Sanskrit grammarians (see Donegan 1978 and Nathan 1989). The present proposal deviates from these earlier accounts in that it integrates different types of acoustic energy into a single scale of perceptual pitch intelligibility, and treats sonority in terms of energy that attracts syllabic nuclei when accumulated to a sufficient degree.

Attraction of syllabic elements is not novel in prosodic phonology. In \textit{weight sensitive} systems, stress is attracted to heavy syllables. In comparable terms of the current proposal, increased vocalic duration attracts the most prominent nucleus – that of the stressed syllable. Increase in duration and/or intensity, the main phonetic cues for stress (Fry 1955, 1958), indeed enhance periodic energy of sonorant portions over and above what the segmental makeup delivers. The proposal here is therefore for a single mechanism whereby \textit{sufficiently} periodic energy attracts nuclei and \textit{enhanced} periodic energy attracts prominent nuclei.

Nucleus attraction makes different predictions than the \textit{Sonority Sequencing Principle} (SSP), the most well-established principle relating to sonority. The SSP defines the terms \textit{rise}, \textit{fall} and \textit{plateau} for successive strings of segments, with the simple idea that syllabic margins (onset/coda) optimally rise in sonority towards the nucleus. The SSP accounts well for types of sequential \textit{slopes} but it is blind to the absolute sonority levels of segments (i.e. the \textit{intercepts} of the slopes). To exemplify this problem, consider the onset clusters in (1). In terms of the SSP they are identical (same sonority; \textit{plateaus}) but the more sonorous plateaus on the right should be regarded as more marked and illformed complex onsets.

(1) $sfV < zVv < nmV < jwV$

A general principle of nucleus attraction (see 2) can discriminate between the clusters in (1), given that the more sonorous plateaus entail greater competition for nucleus attraction between
the vowel and C1. Crucially, violations in this model are proportional to the degree of competition within syllables such that greater competition intensifies illformedness.

(2) Nucleus Attraction Principle: Every sufficiently periodic peak in the stream of speech attracts one unique nucleus

Note that (2) is an asymmetrical restriction that defines criteria for perceptual syllabicity among portions that are sonorous enough (i.e. sufficiently periodic) to compete for attraction. As a result, widely attested cases of sC-clusters (e.g. star) simply do not incur violations, contra to the SSP, due to the minimal nucleus attraction of voiceless segments. However, when sonorant segments are involved, the potential competition for nucleus attraction within syllables yields an elaborate set of predictions, much richer than the SSP. All the examples in Table 3 (next page) incur identical SSP violations (onset fall) but differences in competition for nucleus attraction suggest systematic improvements in terms of syllabic wellformedness.

The current proposal is functionally motivated: A bottom-up view is supported by the fact that the human auditory system has evolved with dedicated mechanisms to detect periodicity (e.g. phase locking; Wever and Bray 1937); A top-down view is supported by the fact that pitch events are required at some level of the phonology of all languages (tone, intonation etc.). The fact that the syllabic/moraic unit is generally taken to be the anchor for pitch events further strengthens the functionality of this proposal, which ties periodicity to syllabicity.

Table 1. Correlating sonority with pitch intelligibility (PI) as a measure of periodicity*

<table>
<thead>
<tr>
<th></th>
<th>Periodic Energy</th>
<th>Aperiodic Energy</th>
<th>PI/ Sonority</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vowels</td>
<td>Very strong</td>
<td>(Minimal)</td>
<td></td>
</tr>
<tr>
<td>Semivowels/glides</td>
<td>Strong</td>
<td>(Minimal)</td>
<td></td>
</tr>
<tr>
<td>Liquids</td>
<td>Mid</td>
<td>(Minimal)</td>
<td></td>
</tr>
<tr>
<td>Nasals</td>
<td>Weak</td>
<td>(Minimal)</td>
<td></td>
</tr>
<tr>
<td>Voiced obstruents</td>
<td>Weak</td>
<td>Weak</td>
<td></td>
</tr>
<tr>
<td>Voiceless obstruents</td>
<td>(Minimal)</td>
<td>Strong</td>
<td></td>
</tr>
</tbody>
</table>

To account for divisions between stops and fricatives, the transience of the release phase in stops (short burst) should be considered as detrimental to pitch intelligibility (see Table 2).

Table 2. Obstruents’ pitch intelligibility (PI) as a measure of periodicity and transience

<table>
<thead>
<tr>
<th></th>
<th>Periodic Energy</th>
<th>Aperiodic Energy</th>
<th>Transient release</th>
<th>PI/ Son.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Voiced fricatives</td>
<td>Weak</td>
<td>Weak</td>
<td>(No)</td>
<td></td>
</tr>
<tr>
<td>Voiced stops</td>
<td>Weak</td>
<td>Weak</td>
<td>(No)</td>
<td></td>
</tr>
<tr>
<td>Voiceless fricatives</td>
<td>(Minimal)</td>
<td>Strong</td>
<td>(No)</td>
<td></td>
</tr>
<tr>
<td>Voiceless stops</td>
<td>(Minimal)</td>
<td>Strong</td>
<td>Strong</td>
<td></td>
</tr>
</tbody>
</table>

Table 3. Paths for improvement of syllabic wellformedness in complex onset falls

<table>
<thead>
<tr>
<th>Onset change</th>
<th>Description</th>
<th>Weaker competition due to</th>
<th>SSP predicts</th>
</tr>
</thead>
<tbody>
<tr>
<td>IpV → zpV</td>
<td>C₁ decreases w.r.t. C₂</td>
<td>Decrease in degree of slope</td>
<td>No difference</td>
</tr>
<tr>
<td>IpV → IvV</td>
<td>C₂ increases w.r.t. C₁</td>
<td>Decrease in degree of slope</td>
<td>No difference</td>
</tr>
<tr>
<td>lmV → zhV</td>
<td>C₁ &amp; C₂ decrease together</td>
<td>Decrease in level of intercept</td>
<td>No difference</td>
</tr>
<tr>
<td>lbV → spV</td>
<td>C₁ decreases more than C₂</td>
<td>Decrease in slope &amp; intercept</td>
<td>No difference</td>
</tr>
</tbody>
</table>

* Periodicity makes reference to both periodic and aperiodic energy (see Rosen 1992).
References
A substantive bias for perceptually minimal alternations in Artificial Grammar learning

A growing body of work has investigated the cognitive basis of typological asymmetries, using Artificial Grammar tasks to investigate acquisition of phonological patterns by adult learners in the lab. Abundant evidence has emerged for formal preferences regarding the scope and application of rules (simplicity, transparency, locality), but substantive preferences for typologically common processes have proven more elusive, leading some researchers to question whether typological frequency has a universal cognitive basis (see Moreton and Pater 2012a,b for review). Nonetheless, preferences for specific phonological processes have emerged in various studies (Wilson 2006; Carpenter 2010; Greenwood 2016), so the real challenge (as with all phonological analysis) is determining which typological asymmetries reflect grammatical constraints or biases. In this talk, we investigate a bias for perceptually minimal alternations (P-Map hypothesis; Steriade 2001). We present experimental results showing a preference for the typologically common process of final devoicing over a rare/unattested process of final nasalization. As observed by Steriade (2001), if a language bans final voiced obstruents, they are generally repaired by devoicing rather than by other processes. Final devoicing also emerges spontaneously in L1 and L2 acquisition (Stampe 1979; Broselow 2004) and is acquired rapidly (van de Vijver and Baer-Henney 2011), leading some to posit an innate bias. Steriade (2001) attributes this bias to the fact that final voicing contrasts are perceptually difficult, and devoicing is the 'minimal' repair. To test for bias, we designed an experiment in which singular/plural pairs exhibited final devoicing (deIp ~ deIb-i:) or nasalization (t tô:m ~ t tô:m-i:). Equal numbers of devoicing and nasalization items were presented, so that both processes received equal support in training (6 each). Fillers included items with non-alternating voiceless stops (18), nasals (18), and liquids (6). The plural suffix harmonized in backness with the preceding vowel, and participants were explicitly told to learn the suffix quality. Implicit learning of final obstruent alternations was tested by presenting untrained plurals, with a forced choice between singulars with devoicing, nasalization, or neither. To test generalization to unseen segments, participants were trained on two places of articulation, and tested on all three (labial, coronal, dorsal). Ninety native English speakers were recruited via Amazon Mechanical Turk from U.S. I.P. addresses. The results are shown in Figure 1. A mixed effects poisson regression model reveals no significant differences across training conditions; alternations generalized equally regardless of which place of articulation was withheld. Response type (Helmert coded) shows a significant preference for non-alternation over alternations (p < .0001) and, crucially, for devoicing over nasalization (p < .05). Thus, although both alternations were presented equally in training, participants generalized devoicing more readily. This bias is 'soft' (participants were able to learn final nasalization to some extent), but the direction is consistent with the P-Map hypothesis. Furthermore, this bias is unlikely to come from native language experience. English does not have systematic devoicing or nasalization alternations, and prior
knowledge of this may contribute to the strong observed preference for non-alternation, but would not favor devoicing. When we consider rates of alternation across different places, we find an unexpected effect, however: regardless of which place was withheld, we find significantly higher rates of nasalization for /g/. This preference for [n] is not mirrored in typology or acquisition. We hypothesize that it is an artifact of the experimental design: [n] items were phonotactically and orthographically odd for English speakers, and were thus a salient feature of the artificial language. A follow-up is underway in which [n] training items are removed, and phonotactic ratings of test items are collected, in order to control further for phonotactic confounds.

![Graph showing proportion of responses across training conditions](image)

**Figure 1: Proportion of responses across training conditions**

| Factor                          | Coefficient | Std. Error | z    | p(>|z|)     |
|---------------------------------|-------------|------------|------|------------|
| Intercept                       | -1.295      | 0.052      | -25.00| <.0001***  |
| Response:                      |             |            |      |            |
| Alternating vs. non-alternating | 0.161       | 0.073      | 2.22 | .0267*     |
| Devoicing vs. nasalization     | 0.420       | 0.030      | 13.86| <.0001***  |
| Training:                      |             |            |      |            |
| Withhold Labials               | 0.028       | 0.070      | 0.40 | .6881      |
| Withhold Coronals              | -0.036      | 0.074      | -0.48| .6301      |
| Response(alternating) × No labials | 0.005      | 0.098      | 0.05 | .9609      |
| Response(alternating) × No coronals | 0.069      | 0.105      | 0.65 | .5129      |
| Response(devoicing) × No labials | -0.031     | 0.0412     | -0.76| .4491      |
| Response(alternating) × No coronals | 0.035      | 0.043       | 0.80 | .4231      |

**Table 1: Coefficients from mixed effects poisson regression**

**References**


Majed Alzhrani

Alatawalah Arabic Stress: A Stratal OT Analysis

Stress in Alatawalah Arabic (AA) falls on the rightmost heavy syllable but if no heavy syllable exists, it falls on the rightmost trochaic foot, e.g.;

(1) /mās. raː:b/ ‘alley/ lane’
(2) /gaː. ruːːh/ ‘bottle’
(3) /kun daː.rah/ ‘shoe/shoes’
(4) /haː.ʒa.ːh/ ‘a kind of bird’

Classical OT accounts for stress in the above examples by ranking WSP (stress falls on a heavy syllable only) higher than ALIGN-HR (the right edge of the word coincides with the primary stress foot). See Tableau 1 below. However, presence of noun possessive suffixes and verb subject and object suffixes forces stress to fall on no further left than the penultimate syllable even if the antepenultimate syllable is heavy, e.g.;

(5) /mās. raː.boː.ːhum/ ‘alley/ lane-their’
(6) /ʒar. raː.bət/ ‘tried-she’
(7) /raf. ʃaː.ːh/ ‘he deceived-her’

The ranking WSP » ALIGN-HR (in Tableau 1) renders the wrong (winning) candidates in 5, 6 and 7 (* /mās. raː.boː.ːhum/, * /ʒar. raː.bət/ and * /raf. ʃaː.ːh/). This means classical OT cannot explain AA stress. However, stratal OT accounts for 5, 6 and 7 by considering them word-level entities whereas 1,2,3 and 4 are stem-level entities. Reversing the constraint ranking in Tableau 1 (WSP » ALI-HEAD-R → ALI-HEAD-R » WSP) produces the right candidates in 5, 6 and 7. See Tableau 2 below. The stress constraints of the word level can see suffixes and includes them in the stress process (see Tableau 2 page 2). This indicates that the stress-related constraints of the stem level cannot see suffixes and thus exclude them from the stress process altogether. A good example of suffixes ignored by stress in the stem level is the locative suffix, e.g.;

(8) /waː. raː.ːhun ːnah/ ‘behind-them FEM’
(9) /gud. daː.ːm ːkun. ːnah/ ‘front-you PL FEM’

Stress constraints of the stem level ignore both /hun ːnah/ ‘them FEM’ and /kun. ːnah/ ‘you PL FEM’ in 8 and 9, respectively, and place the stress on locatives ( see Tableau 3 in Page 2). Another suffix type that is ignored by stress constraints in the stem level is the dual suffix /ɛːn/,
The stress of AA is best explained by stratal OT which allows different constraint rankings at the stem level and word level that help predict the irregularity of stress placement. In addition, stratal OT at the stem level incorporates stems without their suffixes which is totally unlike word level OT which deals with words with suffixes.

**Tableau 1**

<table>
<thead>
<tr>
<th>Candidates</th>
<th>WSP</th>
<th>ALIGN-HEAD-R</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. ṭe(mıs).ra:b</td>
<td></td>
<td>*</td>
</tr>
<tr>
<td>b. ṭe(mıs).ra:b</td>
<td></td>
<td>*</td>
</tr>
<tr>
<td>a. ṭe(kun).de.ı̇dıl</td>
<td></td>
<td>*</td>
</tr>
<tr>
<td>b. ṭe(kun).de.ı̇dıl</td>
<td></td>
<td>*</td>
</tr>
<tr>
<td>a. ṭe(ha.ı̇mıs).ı̇dıl</td>
<td></td>
<td>*</td>
</tr>
<tr>
<td>b. ṭe(ha.ı̇mıs).ı̇dıl</td>
<td></td>
<td>*</td>
</tr>
</tbody>
</table>

**Tableau 2 (word level)**

<table>
<thead>
<tr>
<th>Candidates</th>
<th>ALIGN-HEAD-R</th>
<th>WSP</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. ṭe(mıs).ra.(be.-hum)</td>
<td></td>
<td>*</td>
</tr>
<tr>
<td>b. ṭe(mıs).ra.(be.-hum)</td>
<td></td>
<td>*</td>
</tr>
<tr>
<td>c. ṭe(mıs).ra.(be.-hum)</td>
<td></td>
<td>*</td>
</tr>
<tr>
<td>a. ṭe(ızar).ra.b-at</td>
<td></td>
<td>*</td>
</tr>
<tr>
<td>b. ṭe(ızar).ra.b-at</td>
<td></td>
<td>*</td>
</tr>
<tr>
<td>a. ṭe(ızar).ı̇dıl</td>
<td></td>
<td>*</td>
</tr>
<tr>
<td>b. ṭe(ızar).ı̇dıl</td>
<td></td>
<td>*</td>
</tr>
</tbody>
</table>
Tableau 3 (stem level)

<table>
<thead>
<tr>
<th>Candidates</th>
<th>WSP</th>
<th>ALIGN-HEAD-R</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. (\text{Εω} . \text{μ} \text{μ} \text{μ} \text{μ} \text{μ} ) (\text{wa. (`ra:).hun.nəh})</td>
<td></td>
<td>**</td>
</tr>
<tr>
<td>b. (\text{μ} \text{μ} \text{μ} \text{μ} \text{μ} \text{μ} ) (\text{ (`wa).ra:.hun.nəh})</td>
<td>!</td>
<td>***</td>
</tr>
<tr>
<td>a. (\text{Εω} . \text{μ} \text{μ} \text{μ} \text{μ} \text{μ} \text{μ} \text{μ} \text{μ} \text{μ} \text{μ} ) (\text{(gud). (`da::m)-ə.kun.nəh})</td>
<td></td>
<td>***</td>
</tr>
<tr>
<td>b. (\text{μ} \text{μ} \text{μ} \text{μ} \text{μ} \text{μ} \text{μ} \text{μ} \text{μ} \text{μ} \text{μ} \text{μ} \text{μ} \text{μ} \text{μ} ) (\text{(gud).(da::m)-ə.kun.nəh})</td>
<td></td>
<td>****</td>
</tr>
</tbody>
</table>

References
In this study, I will report the results of an on-going corpus study on Turkish Vowel Harmony (TVH), which can be described as a process in which a non-initial vowel agrees with the preceding vowel in terms of frontness/backness and, if it is high, also in rounding. After having conducted a dictionary survey and another corpus study (using TS corpus, Sezer & Sezer 2013) based on frequency of use (Avar 2015), the rate of disharmony in Turkish was found to be substantial, especially when we look at loanwords -as already reported in the literature- (cf. Clements & Sezer 1982 among others). In order to test for the psychological reality of TVH, I also conducted psycholinguistic experiments where certain regularities were found with respect to how Turkish native speakers deal with disharmony. In particular, it was found that the majority of speakers tend to use irregular –i.e. non-final- stress patterns when reading out loud disharmonic nonce words embedded in a Turkish narrative (Avar 2016). Upon looking at the phonological shape of frequently used disharmonic words I already had found that the significant majority of them either had an irregular stress and/or had long vowels. Thus I arrived at a hypothesis that stress and vowel length play a role in TVH. In order to further test my hypothesis, I started looking at the rate and nature of disharmony in children’s speech.

I analyzed the data provided by Aksu Corpus at CHILDES. The corpus contains 54 files in the form of transcriptions of conversations with children with an age range of 2;0 to 4;8. Leaving out the adults’ utterances, onomatopoetic words, proper names, compounds, and monosyllabic words, the corpus had a total number of 5,557 types and 25,674 tokens (as word-forms). Among those, the rate of harmonic word-forms was 76%. As a next step, I analyzed the nature of disharmonic words. In 792/3,333 (types/tokens) of them, disharmony was caused by a non-alternating suffix (and, in particular, 3,218 due to the progressive suffix –(I)yor which also has an irregular stress-assignment). A closer look at the remaining 557/2,392 revealed a total number of 279 distinct disharmonic roots, the most frequently used ones being an:e ‘mother’ (523 times), and ta:ne ‘piece’ (161 times).

While the analysis continues, the observations of the data so far are as follows: Among the disharmonic sequences, (i) 24.7% have an irregular stress pattern, (ii) 29.8% have a long vowel, and (iii) the overwhelming majority of a-u sequences (7.9% of all disharmonic sequences) can be explained by labial attraction rule (Lewis 1967). The fact that there was a sonorant segment dividing up the disharmonic sequences in the most frequently used words lead me to a further analysis, which revealed that 48.4% of all disharmonic sequences are divided up by m, n, l or r – the four consonants in Turkish that are known to have an effect on the quality of a preceding /e/ (cf. Operstein & Kütükçü 2004 among others).

Moreover, if we embrace unary elements rather that binary features as phonological primes, and assume that all root vowels can be lexically specified, it can be argued that true disharmony occurs when an element fails to spread even though the conditions for its spreading are met. From this point of view, for instance, an a-i sequence does not violate harmony, while the reverse
does. Approaching the data this way, only 20% of the sequences remain to be disharmonic in the strong sense.

The study is far from being complete, but it aims to shed light on the unsolved issues on TVH by suggesting that the process is more complicated than considered so far in that it is affected by -rather- external factors such as quality of neighboring consonants, stress and vowel quantity.

References
Merouane Benhassine

Phasal Spell-Out does not implie Concatenation

Distributed Morphology (DM), a unified approach to word and sentence formation, regards Morphosyntax as ‘a single concatenative engine’, responsible for gluing together words and morphemes alike, using a single device: Merge (Marantz 1997, 2001). The view that concatenation is the only possible post-lexical morphological operation is quite widespread in DM theoretic approaches to the Morphology-Phonology interface (Marvin 2002, Samuels 2010, Lowenstamm 2011, Embick 2013, among many others). In this talk, I show that concatenation in the (morpho-)syntactic side (i.e. the application of Merge) does not always result in concatenation in the phonological side, even for post-lexical (or phasal) derivations. Two main arguments support this claim: the first is a phonological diachronic argument. Phasal derivation has immediate diachronic corollary: if Y is post-lexically derived from X, then any change in X (be it phonological or semantic) will also affect Y. The phonological change discussed here is the phonemisation of emphatic /rQ/ and non-emphatic /r/ in Maghrebi Arabic (MA). This phonemic split resulted in a unidirectional, systematic but grammatically-conditioned levelling in the verbal domain (always on the basis of the /r/-variant defined in the imperfective, as in (1)), but in no uniformisation at all in the nominal domain (e.g. jarQ (sing.) ~ jiran, *jirQ an (pl.) ‘neighbour’; miharQ ma (sing.) mharim, *mharQ im ‘veil’).

(1) Imperfective Perfective Active Participle
    ydurQ ydir      darQ [darQ] dayirQ [dajarQ] ‘to turn’
    ydir      dar [dér] dayir [déjir] ‘to do’

Active participles of unaccusative verbs were not subject to this levelling. Crucially, participles of unaccusatives can only be stative in MA. A DM analysis straightforwardly, and at no additional cost, explains the lexical propagation of the /r/-/rQ/ split in MA, and correctly predicts the differences we find between its propagation in the verbal and nominal paradigms, as well as the ‘exceptions’ we find in the verbal domain. This shows that templates behave in Morphosyntax exactly like affixes do: they can be cyclic (i.e. introduced below the first categorising head, as is the case, I argue, for stative participles and broken plurals) or non-cyclic (introduced above the first categorising head, e.g. for eventive participles):

(2) Non-cyclic template: Eventive Participles: [PartP Part [VoiceP √CaCiC [vP v [√P √stem]]]]
    Cyclic template: Stative Participles: [PartP Part [√P √CaCiC √stem]]
    Broken plurals: [nP n [NumP CCaCiC [√P √stem]]]

The second argument is morphological one. I argue that a Root & Template theory is not an adequate theory of MA morphology and show that cyclic templates behave differently from noncyclic ones in terms of lexical selection and segment-to-template association mechanisms (in terms of directionality of association, (un)separability of geminates). I conclude that not all phases are equipped with a Phase Impenetrability Condition (PIC) – at least in the (Morpho)Phonology component – and that Spell-Out is not synonymous with what can be termed ‘Externalisation’,...
corroborating the architecture of Grammar argued for in Idsardi & Raimy (2013), in (3):

(3) Narrow Syntax > Morphosyntax > Morphophonology > Phonology(-Phonetics)

I finally suggest that the peculiar behaviour of deaf verbs in the modern Arabic dialects, along with other Output-Output correspondences in Semitic languages (Ussishkin 1999) are all a trivial consequence of a fundamental property of the Morphophonology module: adjacency. These effects merely result from the passage of a lexical, multi-layered phonological representation to a post-lexical linear representation: this would ensure that locally adjacent segments remain adjacent during all post-lexical derivations.

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Iris Berent, Outi Bat-El, Diane Brentari & Vered Vaknin

The double identity of doubling: one language faculty, two channels

Does knowledge of language consist of abstract principles, or is it fully embodied in the sensorimotor system? Consider, for example, the ban on identical phonological elements (e.g., the two coronals in dla). Do such violate abstract grammatical rules (e.g., the OCP(1)) or are they avoided only because they are difficult to perceive and articulate(2)?

To address this question, we investigate the double identity of doubling. Doubling (generally, XX, where X stands for a phonological constituent) presents a case of structural ambiguity. At the phonological level, doubling (e.g., cocoa) is encoded as repeated phonological elements, i.e., as phonological identity (XX). But when the same input is parsed as morphological reduplication (e.g., in the Ilocano word hoe-hoe ‘to paddle continuously’, from hoe ‘to paddle’), doubling is encoded as a single constituent, X, and its copy “Xₗ” (hoe, where subscript “c” stands for copy) (3), or generally, as XXₗ.

These different parses each violates distinct constraints within the grammar (see Tableau 1). Phonological identity, XX, (e.g., cocoa) violates a putatively universal ban on identical elements (i.e., the Obligatory Contour Principle, OCP (1)) and consequently, phonological identity is worse formed than no-identity controls (e.g., cocoa<copo). Viewed as morphological reduplication (e.g., hoe-hoe), however, doubling is represented as a single constituent hoe and its copy (hoe,) (3), akin to a person and her image in a mirror, so the phonological ban on identity is inapplicable. In fact, morphological reduplicative forms are superior to the non-reduplicative alternative (e.g., hoe-po) inasmuch as they add no new material to the base (i.e., in line with DEP (4)).

This analysis predicts that doubling preferences should shift depending on its level of analysis. Viewed as phonological identity, doubling should be disliked, but when parsed as morphological reduplication, the doubling aversion should turn into a preference. Our investigation tests this proposal.

In Exp.’s 1-4, participants were asked to make a forced choice between a matched pair of novel English words exhibiting either (partial) doubling (e.g., slaflaf) or no doubling (e.g., slafmak). Results showed that, when these words were presented in isolation, as pure phonological forms (in Exp. 1), people systematically disliked doubling (see Figure 1). But once doubling was presented as morphological plurality (by first pairing the base slafl with a single object, and next presenting slafla or slafmak as possible names for a homogeneous object set), the doubling aversion shifted in a reliably preference. Exp.’s 3-4 established that this shift only occurs when a morphological interpretation is viable. Specifically, we found no doubling preference when the base was omitted (in Exp. 3) or when the plural set was heterogeneous (in Exp. 4a), in violation of the conditions for semantic plurality. But once the morphological link between the base and doubling was reintroduced (by presenting them as names for an object vs. a homogeneous set), the doubling aversion turned into a preference (in Exp. 4b). Since the stimulus is unchanged, these conflicting preferences must reflect competing linguistic principles, rather than the sensorimotor demands imposed by the stimulus itself.
We next demonstrate that English speakers without experience in sign language spontaneously project these principles to novel signs in American Sign Language (ASL). The procedure closely followed Exp.’s 1-4, except the stimuli consisted of novel signs. Results showed that, when presented with signs as names for a single object (i.e., as purely phonological forms), people systemically disliked reduplicated (XX) signs compared to non-reduplicated (XY) controls (see Figure 2). But once doubling was presented as a morphological operation (by first pairing the base X along with a single object, and next eliciting a forced choice between XX and XY forms as names for a homogeneous object sets), the doubling disliked shifted into a reliable preference. Exp.’s 6-8 established that this shift only occurred when a morphological analysis was viable, as no doubling preference obtained when the base was paired with a heterogeneous object set (Exp. 6b; Exp. 8a), or when the base was removed (in Exp.’s 7a-7b). However, once the base was repaired with a homogeneous object set, the doubling preference reemerged (Exp. 8b).

Together, these results show that linguistic preference doubly-dissociate from the sensorimotor demands of linguistic stimuli. A single linguistic form can elicit contrasting preferences, depending on its level of analysis—the phonology vs. morphology. Yet, these preferences remain invariant despite radical changes to the sensorimotor characteristics of the input—from speech to sign. These results challenge the possibility that linguistic preferences are directly determined by the motor system. However, these findings are fully in line with intermediate view, where sensorimotor pressures shape the design of the system indirectly, in ontogeny and phylogeny, to favor the emergence of a “functionally sensible” system of abstract universal grammatical rules (5).

Tableau 1  Costraint violation at the phonological and morphological levels.

<table>
<thead>
<tr>
<th>Example</th>
<th>Structure</th>
<th>OCP</th>
<th>DEP</th>
</tr>
</thead>
<tbody>
<tr>
<td>cocoa</td>
<td>XX</td>
<td>*</td>
<td></td>
</tr>
<tr>
<td>copo</td>
<td>XY</td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>hoe-hoe</td>
<td>XX&lt;sub&gt;c&lt;/sub&gt;</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>hoe-po</td>
<td>XY</td>
<td></td>
<td>*</td>
</tr>
</tbody>
</table>

Tableau 1  Costraint violation at the phonological and morphological levels.
Figure 1. Doubling preferences for novel English words. Scatter plots present the reduplication responses of individual participants, columns indicate the means, and chance level is marked by the dotted line.

Figure 2. Doubling preferences for novel ASL signs. Scatter plots present the reduplication responses of individual participants, columns indicate the means, and chance level is marked by the dotted line.

References
Paul Boersma

The emergence of phonological categories in a Deep Belief Network

This research combines two strands from different disciplines, namely (1) existing types of “deep” models of phonology, and (2) existing types of “deep” artificial neural networks in machine learning.

For models of phonology, the term “deep” refers to models that embrace many levels of representation. Thus, apart from positing only two discrete phonological levels, namely the underlying form and the surface form, one can add a form in between these that separates the lexical from the postlexical phonology (Mohanan 1981, Kiparsky 1982), and/or one can add phonetic representations such an auditory form and an articulatory form (Boersma 1998), and/or one can distinguish multiple strata within the lexicon (Bermúdez-Otero 2003), and/or one can add a morphosyntactic level, especially if it is sensitive to postlexical phonology (Boersma & Van Leussen to appear).

For artificial neural networks, the term “deep” refers to networks that consist of many levels, especially of the types that were difficult to train before Hinton & Sakhabutdinov (2006) showed that training Deep Belief Networks, i.e. stacks of Restricted Boltzmann Machines (RBM; Smolensky 1986), was a really good first step in designing multi-level networks that would later go on to achieve immense successes in image recognition (Krizhevsky et al. 2012), speech recognition (Hinton et al. 2012), and the game of Go (Silver et al. 2016).

We observe similarities and analogies between deep models of phonology and deep artificial neural networks, and not only in the multiplicity of the levels. The way in which AlphaGo (Silver et al. 2016) beat the world’s best Go player of the last decade was by applying strategies that top Go players also follow: a good prediction of most likely next moves given a position (the “policy network”), a good prediction of the winner given a position (the “value network”), and a large number of tried out move sequences sampled by the policy network and with their end positions evaluated with the value network. This uncanny similarity also plays a role nowadays in face recognition in your phone, in self-driving cars, and so on. For this reason, Zorzi et al. (2013) assert that Deep Belief Networks will be able to model all aspects of human cognition. I believe that, and I start by modelling phonology.

The simplest Deep Belief Network contains two RBMs. To model the incoming sound, the first level contains 30 nodes that represent places along the basilar membrane and/or its representations in the auditory cortex. The second level has 50 nodes, the third level 10 nodes. We train this network by feeding it sounds drawn from a Spanish-like distribution of F1 (first-formant) values, i.e. a the continuum [u, o, u], where the regions around nodes 8, 16 and 23, i.e. sounds around [u], [o] and [u], were slightly (but only slightly) more frequent than sounds in other regions. With this scheme I trained the first RBM 10,000 times with a learning rate of 0.001, and after that the second RBM in the same way. After training, I tested the two RBMs together by applying the sweep [u, o, u], shown in Figure 1a, to the input (the shape is very close to what a spectrogram of this sweep would look like). This sweep percolated up via the first hidden
level to the second hidden level, and then reflected back from the second hidden level via the first hidden level to the input level. The resulting reflected input activation is shown in Figure 1c. The network appears to think that the input consisted of only three different sounds (prototypes of the categories, so to say) rather than a continuum of sounds. The cause is that at the second hidden level there are only three different possible activation patterns, which is precisely what categorization means. If we train the network with much less data, only the marginal distribution of F1 values is learnt (Figure 1b), and if we train the network with much more data, the input sound is reflected faithfully, as we expect from deep networks (Figure 1d). A network that truly behaves like humans would have to stop at the stage of Figure 1c, the categorization stage. I conclude that the simplest case of threefold category emergence along a single auditory continuum is correctly handled by a simple DBN, although this network can be sensitive to overtraining. This kind of networks likely hold a large promise for future linguistic modeling.

Fig. 1. Rise and fall of three-way categorization in a Deep Belief Network.

References


Karolina Broś

Spanish non-continuants at the prosody-phonetics interface

The Spanish of Gran Canaria has been reported to have post-vocalic voicing (\(\text{/p k tj}/ \rightarrow \{b d g j\}\)) inside words and across word boundaries (e.g. Ofstedal 1985): *apasionado* [\(\text{a.basjo.na.}\)] ‘enthusiastic’, *fonetica* [\(\text{fo.ne.di.ga}\)] ‘phonetics’, *tengo una prima* [\(\text{teN.go.u.na.bri.ma}\)] ‘I have a cousin’, etc. What is more, the process is blocked after vowels which become adjacent to the stop as a result of elision: *características* [\(\text{ka.rak.te.ri.ti.ga}\)] ‘features’ (*\(\text{ka.rak.te.ri.diga}\)\), *hacer tonterías* [\(\text{a.se.ton.te.ri.a}\) (*\(\text{a.se.don.te.ri.a}\)\). Thus, coda consonant deletion seems to be of consequence for the phonology: an otherwise extended process of voicing is blocked in the speech of the same speaker that produces voicing elsewhere in the same utterance. At the same time, deletion does not block other phonological processes, such as spirantisation. Given these observations, it can be concluded that both post-vocalic voicing and coda elision are connected speech phenomena belonging to the phonological component.

This study challenges the abovementioned assumption. The data gathered in the course of an experiment conducted among 20 native speakers suggest that the process of post-vocalic voicing is highly coarticulatory and phonetic rather than phonological. First, it can be either partial or total, with inter- and intraspeaker variation. Second, substantial statistical differences can be observed in the frequency of voicing between dorsals (k t j) and non-dorsals (p t). Finally, whereas word-internal voicing is fairly consistent, it is variable across a word boundary, sensitive to pauses and to prosodic phrasing (if speakers parse phonological constituents differently, the voicing does not occur). Given the above, it is difficult to explain why the apparently phonetic process of voicing does not take place in cases of elided consonants.

The study consisted of 79 phrases containing contexts for post-vocalic voicing across a word boundary. Each sentence was structured in the same way: *He comprado cinco* ‘I have bought five’, followed by a noun phrase, e.g. *panes de millo* ‘corn bread’. There were 49 target phrases, each starting with a voiceless non-continuant followed by a vowel or a sonorant (13x[p], 13x[t], 13x[k], 10x[t]) and 15 controls. Each sentence was prerecorded by a trained native speaker in two versions: with and without voicing. The stimuli were then put in random order and presented aurally to the participants in two randomized sets (one per 10 participants). The participants were to listen to the phrases and repeat them. In the second part of the experiment, they were to read the same tokens in a different order. The principal aim of the experiment was to see whether there would be differences in the production of voicing depending on the immediate phonetic context. It was assumed that (1) the process would be consistent, (2) there would be no substantial differences depending on the place of articulation and (3) that the voicing would occur regardless of the (lack of) voicing in the audio stimuli.

The conducted study revealed that there is substantial variability in the produced outputs. Only the third hypothesis was confirmed. Given the variables influencing voicing across participants (context, pauses, phrasing), and the fact that the abovementioned blocking effect of elision needs to be explained theoretically, I assume that non-melodic phonological remnants in the form of
structural elements must be visible in the phonetics component and can exert influence on phonetic processes such as voice spilling across sonorants (e.g. Goldrick 1998). Another, perhaps complementary explanation can be sought in the theory of fine-grained phonetic modulation of speech production at prosodic junctures (Keating 2006; Cho 2016), which assumes phonetic strengthening at domain boundaries (Fougeron & Keating 1997). The gathered data suggest that fast speech rate and lack of physical pauses do not necessarily imply voicing, whereas differences in NP phrasing and the accompanying differences in rhythm, pitch and stress do affect the production of non-continuants. This is in line with the literature on Spanish prosody (Quilis 1993, Navarro 1944). Moreover, it is possible that elided phonological segments structurally mark prosodic boundaries, which is then translated into blocking at the prosody-phonetics interface.

References
Cantonese rising tone alignment as a phonological regularity

Introduction. The study of how fundamental frequency contour (f0) aligns with segments has important implications for not only description of tonal and intonational systems, but also theories of intonational phonology. For example, Xu (1998) found that the f0 peak of the rising tone in Mandarin consistently occurs after the offset of the tone-carrying syllable regardless of speaking rate and whether the syllable has a final nasal. This has been taken as evidence that tone is fully syllable-synchronised, with the peak delay attributed to inertia. This tone-syllable synchrony becomes a foundational assumption of the Time Structure model of the syllable (Xu & Liu, 2006) and PENTA model of intonation (Xu, 2005). However, it remains unclear whether this synchrony can be extended to other tone languages or would autosegmental anchoring of tone targets instead be observed (e.g. Arvaniti et al. 1998). Here we report an experiment on the effect of segmental composition on f0 peak alignment of the two rising tones (i.e. T2 [25] and T5 [23]) in Cantonese.

Method. Meaningful monosyllables /ji:/, /ŋa:/, /ji:m/, and /si:/ were concatenated to form three types of disyllabic non-words—/ji: ŋa:/, /ji:m ji:/, and /ji: si:/ 9 native speakers of Hong Kong Cantonese (5m and 4f, aged 19-28) read aloud these disyllables in a carrier sentence “我講xx俾你聽” (“I say xx to you’). To control for speaking rate, regular beats were played at an interval of 3s and subjects were instructed to read aloud each sentence between two beats.

Results. Segmental composition affects f0 peak alignment of lexical tones in a way reminiscent of intonational tones (D’Imperio, 2000). Figures 1 to 3 show the f0 contour in three types of disyllabic non-words—in /ji: ŋa:/, /ji:m ji:/, and /ji: si/:. 9 native speakers of Hong Kong Cantonese (5m and 4f, aged 19-28) read aloud these disyllables in a carrier sentence “我講xx俾你聽” (“I say xx to you’). To control for speaking rate, regular beats were played at an interval of 3s and subjects were instructed to read aloud each sentence between two beats.

Discussion. No strict segmental anchoring of f0 peak is observed, and its absence cannot be attributed to differential time pressure on the first syllable (Ladd et al, 1999; Schepman et al., 2006) as the two rising tones, despite their distinct slopes, have almost identical peak locations across syllable compositions. We therefore hypothesise that Cantonese rising tone alignment may be regulated at a higher level than segments, with the peak specified as a percentage of the feet. Quantitative evidence of the correlation between feet duration and f0 peak location is used to corroborate this hypothesis. Moreover, unlike Mandarin (Xu, 1998), the peak of the Cantonese rising tones may occur well before the syllable boundary (e.g. /jim: ji:/); these early peaks cannot be the product of inertia and must be phonologically specified as such. This weighs against tone-syllable synchrony as a universal principle and therefore the PENTA model of intonational phonology. Finally, the lack of consistent alignment of f0 peak with reference to syllable boundary casts doubt on the usefulness of classifying tone languages based on the relative degree of carry-over and anticipatory coarticulation, e.g. the same tonal sequence in Cantonese can show...
more anticipatory coarticulation in /ji:m ji/ than in /ji: Na:/.

Future studies on tonal coarticulation should systematically vary segmental compositions to fully explore potential phonological regularity at higher prosodic levels.

**Figure 1 to 3.** f0 contours of T2[25]-Tx (left panels) and T5[23]-Tx (right panels) disyllabic non-words /ji:m ji:/, /ji: Na:/, and /ji: si:/ respectively. X-axis depicts the normalised durational ratio of the segments; y-axis represents the raw f0 values in semitones. Vertical lines represent the location of the syllable boundary (in Figure 1 and 2) and segmental boundary (in Figure 3). The f0 contours of /s/ in Figure 3 are removed as the estimate is unreliable.
Afton Coombs

Boundary Length Provides Evidence of Final-[h] in Tagalog

Overview: Previous accounts have debated whether word-final syllables in Tagalog can be truly open, or whether seemingly open syllables are closed with the consonant [h] (French 1988, Llamzon 1966). The potential coda does not appear well in recordings of bare roots, but [h] will appear under affixation, supporting the argument for a coda. If a coda does exist in seemingly open final syllables, then the surface forms of all words of Tagalog would close with a coda, representing an active case of the constraint FINAL-C (McCarthy 1993, McCarthy and Prince 1993). This study uses phonetic evidence to show that the degree of phrase-final lengthening in final-[h] words is explained by positing that these words close with a consonant at the surface.

Background: Seemingly open word-final syllables have been argued to close with [h]. Problematically, final-[h] does not always appear well in the signal due to its low amplitude (fig. 1). This makes it difficult to measure experimentally, but it does appear under affixation (1).

(1) Possible [h]-final words after affixation (Schachter and Otanes 1972)
   a) tasa(h) ‘cup’ + -an → tasahan ‘measure’  
   b) punta(h) ‘go’ + -an → punthahan ‘go to’  
   c) plantsa(h) ‘iron’ + -an → plantsahan ‘to iron’  
   d) sabi(h) ‘saying’ + -in → sabihin ‘say’

Whether these bare roots end in a coda or not makes different predictions about the degree of boundary lengthening they will undergo. Phrase-final lengthening is a well-attested phenomena found across the world’s languages, and studies of pre-boundary lengthening have shown that it primarily targets the final rime—VC# in a closed syllable, and V# in an open one (Wightman et al. 1992). Measuring only the nuclear vowel of a closed syllable will therefore detect only a portion of the boundary effect. In this study, I test the hypothesis that the debated words of Tagalog do close with a coda – the “ghost segment” [h] – by measuring the length of the nuclear vowel in phrasemediaal and -final contexts and comparing the lengthening effect to that in syllables closed by an oral consonant. The vowel should show a greater lengthening effect in an open syllable (. . . V#), relative to the lengthening effect in a closed syllable (. . . VC#), where the final C absorbs much of the effect.

Method: Ten words of the debated [h]-coda type and the ten words closed with an oral coda were pronounced in phrase-medial and -final position four times each. Four native speakers of Tagalog between ages 25 and 62 participated in this study. In debated words, the nuclear vowel was measured, and in words closed with an oral consonant, the final rime was measured for comparison.

Results: Words containing an oral coda showed a greater durational increase in phrase-final position than did words hypothesized to have [h] in coda (figure 2). Mean lengthening of word-final syllables in those with an oral coda was 95.097 ms and in the debated word type was 5.64 ms. A linear regression mixed effects model was applied, with speaker and iteration as random effects. A model including coda type was a significantly better fit than one that did not (p<0.001). Implications: Languages can require CVC over CV in word-final position, a trend that is captured in a constraint-based framework through FINAL-C. Analyzing Tagalog as requiring a
final consonant in the surface forms of all words places it as a language with an active FINAL-C effect. This study finds that durational increases at boundaries in debated [h]-coda words are small compared to those in words closed with an oral consonant, a result that is predicted if these words truly close with [h], since measurement was of the nuclear vowel only. This analysis accounts for the observed difference in final lengthening and argues that Tagalog requires word-final syllables to be closed.

Figure 1: Example of word-final breathiness

Figure 2: Degree of Phrase-Final Lengthening
References


Bartlomiej Czaplicki

Frequency of use predicts the application of consonant mutations in Polish

It is shown that frequency of use is an essential element of a phonological analysis. Supporting material for this claim comes from Polish data showing the application of consonant mutations. Two types of frequency are important predictors of pattern application: pattern frequency and word frequency. Patterns with different frequencies in the lexicon are considered: \(-ist-a \approx 740\) words, and \(-ek > 1,400\) words. Similarly, an analysis of a corpusbased frequency list reveals that words in \(-ek\) are 11 times more frequently used than words in \(-ist-a\) (in the frequency range 1-10,000). As for the impact of pattern frequency, the less frequent a pattern is in the lexicon, the more susceptible it is to modifications. Regarding word frequency, the more frequent a word is, the more resistant it is to change.

Frequency of use interacts with the preference for transparent bases (Base-Identity). The tendency to avoid mutations is stronger for weaker patterns than for more robust patterns (because it introduces a change). Low frequency and new words fail to show mutations. In addition, the acceptability of mutations is shown to be gradient and dependent on the featural/perceptual similarity of mutated consonants to their base correspondents before \(-ist-a\). Mutations of velars are not attested. As for coronals, mutations of \([t \ d \ r]\) are gradually eliminated, while mutations of \([s \ z \ n]\) are preserved. Mutations that would involve more perceptual contrast (two features) with their base correspondents are avoided (in accordance with Steriade’s 2008 P-maps).

<table>
<thead>
<tr>
<th>(-ist-a) (low freq.)</th>
<th>(-ek) (high freq.)</th>
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<tbody>
<tr>
<td>fle([t]) – fle([te])-ist-a vs. ‘flute’</td>
<td>kro([k]) – kro([tg])-ek ‘step’</td>
</tr>
<tr>
<td>Bonapar([t])-e – bonapar([t])-yst-a</td>
<td>drin([k]) – drin([tg])-ek</td>
</tr>
<tr>
<td>([…t]) ~ ([…ta])-ist-a replaced by ([…t]) ~ ([…ta])-yst-a</td>
<td>([…k]) ~ ([…tg])-ek</td>
</tr>
<tr>
<td>a. mutations</td>
<td>Base</td>
</tr>
<tr>
<td>b. vacillating words:</td>
<td>fle([t]) ‘flute’</td>
</tr>
<tr>
<td>no mutations</td>
<td>(\text{fle}[te]-ist-a) word freq.</td>
</tr>
<tr>
<td>mutations</td>
<td>65000</td>
</tr>
<tr>
<td>c. no mutations</td>
<td>al([r]) ‘alto’</td>
</tr>
<tr>
<td>al([r])</td>
<td>23000</td>
</tr>
<tr>
<td>(+strid)</td>
<td>al([t])-yst-a</td>
</tr>
<tr>
<td>Bonapar([t])-e</td>
<td>Bonapar([t])-yst-a</td>
</tr>
<tr>
<td>(+strid)</td>
<td>5500</td>
</tr>
<tr>
<td>(\text{fle}[te]-ist-a)</td>
<td>(\text{al}[t])-yst-a</td>
</tr>
<tr>
<td>(\text{al}[r])</td>
<td>(\text{al}[t])-yst-a</td>
</tr>
<tr>
<td>(\text{Bonapar}[t])-e</td>
<td>(\text{Bonapar}[t])-yst-a</td>
</tr>
<tr>
<td>(\text{Bonapar}[t])-yst-a</td>
<td>(\text{Bonapar}[t])-yst-a</td>
</tr>
<tr>
<td>(\text{Bonapar}[t])-yst-a</td>
<td>(\text{Bonapar}[t])-yst-a</td>
</tr>
</tbody>
</table>

In an analysis of the data, morphophonological schemas are represented as constraints whose ranking is related to their frequency in the lexicon. Schemas interact with identity con-
straints. Following dual-route models of lexical access (Hay 2003), words are retrieved from memory either by the whole-word route or the decomposed route in response to their frequency. New/rare words are not independently represented in the mental lexicon and are, therefore, more susceptible to base identity pressures. This analysis provides evidence for the integration of generative phonology with usage-based approaches.

References
Semantically opaque prefixes and English phonology

The claim of this paper is that English words with opaque prefixes such as begin, confer, emit or retain are morphologically complex and that this complexity should be accessible to the phonology. Chomsky & Halle (1968: 94) acknowledged the complexity of this type of words and introduced the – boundary to account for their specific stress patterns. This boundary was later rejected by Siegel (1974: 114, 1980) and references to these prefixes in the generative literature were reduced to their specific reduction behaviour (see below). They are also a well-known problem for morpheme-based theories (see Anderson 1992: 55; Aronoff 1976: 12-15; Bauer et al. 2013: 15-16; Katamba & Stonham 2006: 23; Plag 2003: 30-33) because they challenge the standard definition of the morpheme as the minimal meaningful unit.

Some phenomena require the phonology to be able to refer to the internal structure of these words. First, opaque prefixes normally undergo vowel reduction, even in environments where reduction does not normally occur (see e.g. Burzio 1994: 56-57; Collie 2007: 318-319; Giegerich 1999: 231; Pater 2000), which may be due to the high frequency of these prefixes (Hammond 2003). Second, the stress of English verbs, under traditional analyses, is seen as depending on the weight of the final syllable but we claim, following Dabouis & Fournier (in preparation), Fournier (2010) and Guierre (1979) that it is mainly determined by their morphological structure and, more specifically, by the presence or absence of the opaque prefixes considered here. Even though prefixation and syllable weight generally make identical predictions because prefixed verbs often have a heavy ultima (e.g. comply, destruct, retain), words for which they do not, i.e. prefixed verbs with a light ultima (e.g. compél, intermit, rebút), do generally have final stress. Finally, recent empirical work on English secondary stress shows that semantically opaque prefixes influence the position of secondary stress in non-derived words (e.g. amànuén-sis, divèrtiménto, suppòsitítious) and favours stress preservation on the second syllable (e.g. collápsible > collápsibility, remédiate > remédiátion) (Dabouis 2016).

A number of psycholinguistic studies using lexical decision tasks (Taft 1994; Taft et al. 1986; Taft & Forster 1975) or masked priming tasks (Forster & Azuma 2000; Pastizzo & Feldman 2004) show that these prefixes play an important part in lexical access, which is, in certain cases, comparable to that played by semantically transparent prefixes. These studies, along with the phonological phenomena mentioned previously, show that the complexity in these prefixed words can be recognised by English speakers. The first question is therefore how they do so. A number of clues are available which could be used for that purpose. Constructions containing a prefix which can be semantically transparent (e.g. de-, pre-, re-) or a root with relatively transparent semantics (e.g. below (cf. low), rejuvenate (cf. juvenile), revenge (cf. veneful, vengeance)) are more likely to be analysed as morphologically complex. The structure in opaque constructions can be identified through commutations of the prefix (e.g. accept, concept, except, intercept,
percept, precept, recept) or the root (e.g. perceive, percept, permit, certain) (Fournier 1996). Root allomorphy (e.g. {ad-/e-/com/-per/-sub/-trans}-mit > {ad-/e-/com/-per/-sub/-trans}-mission) can be used to identify roots (Aronoff 1976: 12-15). Finally, phonotactics may signal the presence of a complex structure as certain consonant clusters are found only in words with opaque prefixes (Guierre 1990; Hammond 1999: §3.3).

Finally, we discuss the possible advantages of storing a word like permit as per+mit. Two possible answers are that morphological structure is necessary for syllabification, independently of semantic transparency (Levelt et al. 1999) or that “the language acquisition system looks for and uses structure wherever it can be found” (Forster & Azuma 2000).

References

arizona.edu/~hammond/kslides.pdf

The Bantu language Kinande propagates the feature ATR (Advanced Tongue Root) to the left. This regressive vowel harmony (RVH) process optionally extends into the preceding word within the same XP, affecting one, several or all vowels in this extended domain, if it crosses the word boundary (Schlindwein 1987, Mutaka 1990, 1995). The crucial data are given in (1). As shown, the [+ATR] value contributed by the last vowel of the word for ‘short’ /mikuhi/ — obligatorily spreads leftward within the word and optionally crosses the word boundary, affecting the last vowel of the preceding word or a contiguous sequence of vowels that includes the last (Mutaka 1995).

Archangeli & Pulleyblank (2002, henceforth A&P) argue that this RVH process is not phonological but rather a phonetic anticipatory effect, because it is gradient. In this paper we argue that Kinande phrasal harmony is phonological and analyse the pattern and its variation within Optimality Theory. A&P’s argument crucially relies on the interpretation of the term gradience: “The impressionistic evidence is that phrasal ATR harmony is gradient both in how far it goes in a word and in how strongly each vowel is affected” (p. 180) However, the vowels in the RVH domain are clearly classified as belonging to one of the two categories (+ATR or –ATR), which indicates that the strength or degree of affectedness is within-category variation, not the kind of gradience that blurs the boundaries of phonological categories. Variation in the application or range of application of a process can hardly be considered an argument for its non-phonological status. (See, e.g., Coetzee & Pater 2011.) Furthermore, as A&P note, phrasal RVH is phonologically-conditioned: it does not apply if the last vowel is non-high. As work like A&P (1994) argues, [–ATR] high vowels are typologically marked, while non-high vowels are compatible with both [+ATR] and [–ATR]. There is, therefore, no phonetic reason why non-high vowels should impede the articulatory anticipation of the tongue root advancement of the first vowel in the second word.

In addition, Mutaka (1995) shows that RVH is morphosyntactically conditioned. We thus conclude that Kinande phrasal RVH is a genuinely phonological process, amenable to phonological analysis. Our analysis of RVH is cast in Syntagmatic/ABC Correspondence (Hansson 2001; Krämer 1998, 2003; Walker 2011; Rose & Walker 2004), which considers harmony to be implemented by correspondence relations between vowels in surface representations. It furthermore exploits the observation that the phrasal spillover effect is only observed if the last vowel of the first word
has the marked [–ATR, high] feature combination. We propose that the adjacent [+ATR] vowel in
the next word offers an opportunity to reduce the markedness of the final [–ATR, high] vowel in
word 1 by spreading/identity through correspondence. Once [+ATR] crosses the word boundary,
a domino RVH effect is optionally triggered in the preceding vowels. The core idea of the analysis
is illustrated in the tableau overleaf.

(2) OT account of Kinande variable phrasal harmony in a nutshell

<table>
<thead>
<tr>
<th>/èmiti mikùhi/</th>
<th>Max(+ATR)</th>
<th>DEP(+ATR)</th>
<th>Lic(+ATR)/FWD</th>
<th>*Hi–ATR</th>
<th>FAITHFWD</th>
<th>S-IdentSIM</th>
<th>*Mid+ATR</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. èmiti mikùhi</td>
<td>!</td>
<td></td>
<td>****</td>
<td>*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b. èmiti mikùhi</td>
<td></td>
<td></td>
<td>**</td>
<td>*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>c. èmiti’ mikùhi</td>
<td></td>
<td></td>
<td>*</td>
<td>*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>d. èmiti mikùhi</td>
<td></td>
<td></td>
<td>**</td>
<td>*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>e. èmiti mikùhi</td>
<td>!</td>
<td></td>
<td>*</td>
<td></td>
<td>****</td>
<td></td>
<td></td>
</tr>
<tr>
<td>f. èmiti mikùhi</td>
<td>!</td>
<td></td>
<td>*****</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Unranked constraints are subject to random ranking in each evaluation.

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Guillaume Enguehard

Infrasegmental Government or OCP?

The aim of this paper is to argue that the Infrasegmental Government (IG) proposed by Scheer (1996) to account for branching onsets (TR) could be an effect of OCP. I base the following analysis on the CVCV framework introduced in Lowenstamm (1996).

Following Scheer (1996), two adjacent consonants can form a branching onset iff the second contains a resonance element that is lacking in the first (1a). In this case, an IG can apply between the two consonants. This relation is a kind of government in that a non empty position follows an empty position on the same tier (compare with Proper Government in 1b).

In [anonymous], I proposed that Proper Government is an effect of OCP: a V position can remain empty iff it is not adjacent to another empty V on the same tier (2a). I also showed that the specificity of the word-final position (that allows complex codas) is due to the fact that Final Empty Nuclei can be deleted (hatched in 2b) without triggering an adjacency of two C positions that would violate OCP1.

Now, I propose to spread this analysis to IG. First, remark that following Scheer and Szigetvári (2005) the V positions of CVCV are equivalents of weight units. Accordingly, the representation in (3a) should predict that branching onsets are moraic. In other words, the analysis with IG accounts for the fact that we can find CTR sequences, but it does not directly account for the fact that TR is not moraic. For this, it additionally needs to be stated that a nucleus embedded in a IG domain is invisible for phonology.

In the frame of the V = µ equation, the null hypothesis is that (non moraic) branching onsets do not show any embedded empty nucleus. Such an analysis was proposed for example in Lowenstamm (2003), which assumes that branching onsets TR are singletons T^{R} (3b). However, this analysis does not account for the fact that *T^{T} is unattested (e.g. *tp, *bd, etc.).

After having proposed that V positions can be deleted in final position, I now propose that branching onsets are sequences of two C positions that came to be adjacent after the deletion (hatches) of an empty V position (4). This accounts for the fact that TR onsets are non moraic. However, an internal V position normally should not be deleted, because its deletion triggers a violation of OCP when two C positions come to be adjacent. Thus, the issue is: what conditions the possible loss of the V position in TR clusters?

I argue that the basic explanatory principle of branching onsets is that two consonants can form an onset only if they do not belong to the same class. This dissimilarity requirement is accounted for by Scheer’s IG in that the second consonant contains an element that is lacking in the first. Thus, in a TT cluster, the two consonants are not distinct enough to allow the deletion of V: their adjacency would violate OCP (5a). But in a TR cluster, the embedded V can be deleted, because the two C positions that come to be adjacent are linked to segments that are distinct enough (5b).

1In other words, I proposed that CV units do not exist as primitives: they are derived from an OCP constraint.
In conclusion, I propose an analysis that accounts for the nonmorality of branching onsets i. without assuming an extra distinction between visible empty V, invisible empty V and no V; and ii. by preserving the idea that branching onsets are clusters. This analysis is based on a previous proposal arguing that the CVCV structure of the skeleton is an effect of OCP. Nevertheless, this first clue is not sufficient. Indeed, if we assume that a V position can be deleted between two consonants that show enough contrast, then why RT clusters cannot form branching onsets? It seems that this phenomenon implies a directionality that cannot be accounted for by OCP only. Consequently, I assume that sonorants need to be followed by a V position. This assumption is based on the observation, made in Pöchtrager (2001), that this class of consonants can spread to a V position on its right. Accordingly, in the RT cluster in (5c), the embedded empty V position cannot be deleted, even if this is allowed by OCP.

(1) a. Infrasemgmental Government (IG)  
\[
\begin{array}{c}
C & V & C & V & C & V \\
| & | & | & | & | \\
\text{a} & \Box & \leftarrow & \text{A} & i \\
\text{IG} & \Box \\
? & \Box \\
h & \Box \\
\text{french absi 'shelter'}
\end{array}
\]

b. Proper Government (PG)  
\[
\begin{array}{c}
G \\
C & V & C & V & C & V \\
| & | & | & | & | \\
\text{a} & \Box & \leftarrow & \text{A} & i \\
\text{IG} & \Box \\
? & \Box \\
h & \Box \\
\text{french asko 'arched'}
\end{array}
\]

(2) a. moroccan arabic k[i]tbu 'we write'  
\[
\begin{array}{c}
\text{*OCP} \\
V & V \\
| & | \\
C & V & C & V & C & V \\
| & | & | & | & | \\
k & t & b
\end{array}
\]

b. french asko 'arched'  
\[
\begin{array}{c}
C & V & C & V & C & V \\
| & | & | & | & | \\
\text{a} & \Box & \leftarrow & \text{A} & i \\
\text{IG} & \Box \\
? & \Box \\
k & k
\end{array}
\]
(3) a. Scheer (1996)  

\[ \ldots \text{C V C} \ldots \]

\[ \begin{array}{c}
\text{T}\leftarrow\text{R} \\
\text{IG}
\end{array} \]


\[ \ldots \text{C} \ldots \]

\[ \begin{array}{c}
\text{T} \\
\text{R}
\end{array} \]

(4) My proposal  

\[ \ldots \text{C C} \ldots \]

\[ \begin{array}{c}
\text{T} \\
\text{R}
\end{array} \]

(5) a.  

\[ \ldots \text{C C} \ldots \]

\[ \begin{array}{c}
\text{*OCP} \\
\text{T = T}
\end{array} \]

b.  

\[ \ldots \text{C C} \ldots \]

\[ \begin{array}{c}
\text{T} \neq \text{R}
\end{array} \]

c.  

\[ \ldots \text{C V C} \ldots \]

\[ \begin{array}{c}
\text{R} \neq \text{T}
\end{array} \]

References
The two i’s of Qaraqosh Neo-Aramaic

This talk discusses the inflection of the so called /j/-final verbs in the Neo-Aramaic dialect of Qaraqosh (QA) (Khan 2002). Like other Semitic languages, QA displays triconsonantal roots, which are syllabified by means of vocalic patterns (templates). In the infinitive form in Table (1.i), one can see that the verb ‘put’ has a third radical [j] where the ‘sane’ verb ‘open’ has [x]. However, this third radical is not present on the surface throughout the paradigm of ‘put’. In its stead, one finds other differences between the inflections of the two types of verbs. In this talk, we account for these differences. Specifically we treat the following five differences: (i) The appearance of the seemingly epenthetic [i] in the /j/-final 3msg non-past, where it is not required syllabically; (ii) the appearance of [e] rather than [i] in the 2pl and 3pl non-past suffixes; (iii) the mere existence of a three-way distinction in the /j/-final imperative paradigm, where sane verbs exhibit only a two-way distinction; (iv) the vowel [e] of the additional fmsg form; and (v) the vowel [o:] of the plural imperative of /j/-final verbs. In addition, we will account for the [i] -[i:] alternation in [dá:rI] ‘he puts’ vs. [darI] ‘he puts it’. The analysis is conducted within Strict CV (Lowenstamm 1996, Scheer 2004), where the only skeletal constituent is a CV unit; and within Element Theory (Kaye et al. 1985, Backley 2011), whereby all sounds are constructed from a limited set of elements (rather than from features). Especially relevant is the notion of headedness in vowels in this theory: tense and lax counterparts are distinguished by attributing head status to an element of the tense vowel’s make-up, while lax counterparts are unheaded. Thus, tense [i] is headed by element I, while lax [i] has the same element I but it is unheaded (head elements are underlined). First, we assume verbs like ‘put’ are not /j/-final but I-final. We further link the non-head status of this radical I to the fact that it is associated to a templatic slot only when this is necessary (like the phonetically identical epenthetic [i]). In the 3msg [dari] in (2), this I must link to the V-slot because it is not the final one (which can remain empty in QA, e.g. in [pá:tIxi]). The [i] in [dá:rI] is thus both like and unlike the [i] in the parallel [pá:tIxi]. Crucially, however, the realizations of unheaded I and headed I converge in two other scenarios: when they are lengthened because of stress (3; note that all vowels are long in open stressed syllables and that there is no vowel reduction) and when they are associated to a C- slot (4). The plural [dá:re], by analogy to the sane verb in (7), must be /dar?-i/ as in (5) (note that the pl. suffix is headed I). We propose that the vowel becomes [e] by a process of dissimilation and coalescence: the root I is transformed into A to resolve the OCP violation, and the sequence A+I is realized as [e] (6; final diphthongs [aj#] are impossible in QA). We have thus explained facts (i)-(iii) above by assuming a distinction of I vs I. This distinction is necessary for an account of the imperative paradigm. To cover fact (iv), we assume that there is an underlying three-way distinction not only in the I-final verb, but also in the same verb. One must understand then why this distinction does not make it to the surface. Given the base [dri:] (8; again, stress-lengthened I is realized [i:]), the exponent of fsg in the imperative must be that which merges with the base I into [e:]. By analogy to the I+I=>[e] of (5-6), and in accordance with comparative evidence, we assume that this exponent is a high front vowel, in QA either I or
I. If it were I, we would expect to surface in the same verb too (e.g. 7). We conclude that it is unheaded I. In the weak verb it triggers dissimilation and coalescence (9), and in the strong verb it remains afloat, because it is not needed for syllabic purposes in the final V-slot (10). The I vs. I distinction thus receives independent support in the analysis of the imperative paradigm. Finally, if we assume that a sequence of I and U also entails the dissimilation and coalescence process, then the form of the pl. [dro:] also follows from the analysis (11). To conclude, there are two i?is in QA, I and I; the former is both the epenthetic vowel of the language and the third radical of the so-called /j/-final verbs.

<table>
<thead>
<tr>
<th></th>
<th>a. ‘open’</th>
<th>b. ‘put’</th>
<th></th>
<th>a. ‘open’</th>
<th>b. ‘put’</th>
</tr>
</thead>
<tbody>
<tr>
<td>(i)</td>
<td>infinitive</td>
<td>pð bó:x</td>
<td>(iii)</td>
<td>imperative</td>
<td>pð bó:x</td>
</tr>
<tr>
<td>(ii)</td>
<td>non-past</td>
<td>3msg</td>
<td>páːl</td>
<td>x</td>
<td>2fsg</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3pl</td>
<td>pð bó</td>
<td>x</td>
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<td>páːl</td>
<td>x</td>
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<td></td>
<td></td>
<td>2fsg</td>
<td>páːl</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>1msg</td>
<td>páːl</td>
<td>x</td>
<td></td>
</tr>
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<td>1pl</td>
<td>páːl</td>
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<tr>
<td>(4)</td>
<td>d a r</td>
<td>I - a</td>
<td>non-past 3fsg [daːra]</td>
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</tr>
<tr>
<td>(5)</td>
<td>d a r</td>
<td>I - I</td>
<td>/darl+I/</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(6)</td>
<td>d a r A - I</td>
<td>non-past 3pl [darə]</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(7)</td>
<td>p a 0</td>
<td>x - I</td>
<td>non-past 3pl [pá0xi]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(8)</td>
<td>d r</td>
<td>I</td>
<td>imperative 2msg [dřː]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(9)</td>
<td>d r</td>
<td>I - I</td>
<td>/darl+I/</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(10)</td>
<td>p 0 o x I</td>
<td>/pð bóx+/I/</td>
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</tr>
<tr>
<td>(11)</td>
<td>d r</td>
<td>A - U</td>
<td>/darl+U/</td>
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</table>

References
Susanne Genzel

Center of gravity as indicator of right edge boundary tone in Akan

This paper investigates the acoustic differences in the quality of the final vowel between statements (S) and Yes/No questions (YNQ) in Akan (Kwa, Niger-Congo). YNQ in Akan have been claimed to show final „laxness“ (Rialland 2007, 2009). The results neither show a difference between the conditions for H1-H2, H1-A1, H1-A2, H1-A3 nor for the harmonic-to-noise ratio (HNR) and the cepstral peak prominence (CPP). A significant difference is present for the center of gravity (CoG). It is higher in YNQ than in S. This result is taken to indicate that the YNQ in Akan are marked by more speech effort which is due to an additional tonal target at the right edge of the IP (L%). Furthermore, the results show that Akan is not a “lax prosody” language.

Background: Akan is an African tone (Kwa) language with two tones, L and H, spoken in Ghana (Dolphyne 1988). Sentence mode is marked prosodically. YNQ exhibit a higher register, longer final duration, higher final intensity and lower final F0 than statements (e.g. Genzel 2013, Genzel & Kügler 2016). Akan has been classified as „lax prosody“language by Rialland (2007, 2009). „Lax prosody“ is regarded to be similar to breathiness, laryngeal relaxation and reduced speech effort (Ní Chasaide and Gobl, 1997). Breathiness has been shown to come along with increased spectral noise at higher frequencies due to little longitudinal tension resulting in turbulent airflow through the glottis (Gordon & Lagefoged 2001). Hence it is expected that the final vowel of YNQ in Akan terminates in a breathy/lax voice.

Method: Controlled experimental data was collected on a fieldtrip. 4 string identical YNQ/S pairs were recorded 3 times with 6 (1 female, 5 male) native speakers of Akan (Asante dialect). All items end in an /a/, which carries an H tone and was labeled according to Blankenship (2002) in Praat (Boersma & Weenink 2015). It was divided in 4 equally spaced intervals. To access the spectral noise at the higher frequencies H2, A1, A2 and A3 were subtracted from H1 with the help of a Praat script (Remijsen 2004). If the final vowels of YNQ are more breathy/lax, the spectral measures are expected to be higher than for final vowels of S. Further measures of breathiness/laxness include HNR and CPP, both of which are expected to be lower in breathy phonation due to added noise (e.g. Khan 2012). Finally CoG was measured. It is related to the spectral slope and expected to be lower for breathy/lax vowels due to the reduced tension (van Son & Pols 1995). All measures were taken at the temporal mid of each interval. The results of the phonetic analysis were evaluated against the fixed factors SENTENCE MODE with the 2 levels and POSITION with 4 levels in R (R Core Team 2015) using linear mixed models from the „lme4“package (Bates, Maechler, Bolker and Walker 2015).

Results: Contrary to the expectations POSITION did neither significantly affect the four spectral measures nor CPP and HNR. Importantly, no interaction between SENTENCE MODE and POSITION was present. A significant main effect of SENTENCE MODE could be observed for CoG. Unexpectedly, CoG is higher in YNQ than in S. Again, no interaction between SENTENCE MODE and POSITION was present.

Discussion: A higher CoG in Dutch and English has been shown to correlate with perceived
sentence accent (Sluijter 1995a, b) and is thus been connected to a higher speech effort. Taken together with the non-significance of any of the breathiness parameters, the results suggest that YNQ of Akan do not show a lower terminal F0 because of lax voice contrary to Rialland (2007, 2009), but because of an additional tonal target at the right edge of the IP which is absent in S (Genzel 2013, Genzel & Kügler 2016).

References
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**Siri Gjersøe**

**Output-Output Correspondence in Nuer Nominal Inflection**

**Introduction:** This study presents new data on grammatical tone in the Eastern Jikany dialect of the western Nilotic language Nuer. The proposal is that oblique case is expressed by a floating L tone \( \text{\L} \) which either overrides the lexical tone of the stem or associates to a toneless suffix. An interesting pattern is attested on nouns which have a plural suffix in both nominative and oblique forms. Contrary to the overriding pattern, \( \text{\L} \) does not surface in these forms and the suffix retains the tone of the nominative. This is analyzed in an Output-Output Correspondence analysis in OT where the nominative plural serves as a base form for the nouns in oblique case.

**Data:** Nuer attests nominative, genitive and locative case where the two latter are predominantly marked the same (thus referred to as oblique). Declination is remarkably complex with multiple exponents (cf. Baerman 2012). In nouns, number and case inflection can be formed by either stem-internal modification or suffixation. New data show; (i) Nuer has H(igh), L(ow) and HL tones and the syllable is the TBU. (ii) Monosyllabic nouns surface as L-toned in oblique case (table 3, group (a) and (2)). (iii) The suffix -ni is H-toned in nominative plural (cf. table 5, left column), and L in the oblique plural (cf. table 3, group (b)). The exception regards nouns which have -ni in both nominative and oblique (table 5, right column). Analysis: The tone pattern of case inflection in Nuer is analyzed with OO Correspondence with the ranking in (8). The nominative plural of a given lexical item is the base form of an input noun. The proposed constraint is OO-ANCHOR(AFFIX TONE,R) which demands OO correspondence between the rightmost affix tone of the affiliated form and the base. Whenever the base has a suffix with an associated tone, the tone of the oblique suffix will be faithful to it. The exponent of oblique case is the floating L tone; \( \text{\L} \) which overrides a H- or HL-toned monosyllabic stem and vacuously overrides a L stem (pattern in table 3a). Failure of associating \( \text{\L} \) violates MAXFLOAT (Wolf 2007), a constraint which militates against floating tones in the input which are not associated to a TBU in the output. For H-toned stems, the overriding pattern of \( \text{\L} \) is preferred over an output where the lexical H tone is retained and \( \text{\L} \) creates a new contour tone because of the ranking of *DIFFAL\(_\alpha\). The plural suffix -ni is analyzed as underlyingly toneless marking plural. When -ni is added to the stem in oblique, \( \text{\L} \) associates to this suffix (pattern in table 3b). Failure of this association would violate both Have-Tone, which militates against toneless syllables in the output, and MAXFLOAT. In tableau (9), the input is a H-toned monosyllabic noun with the oblique exponent \( \text{\L} \). The base is the suffixless nominative plural \( \text{\G} \). Because there is no affix tone in the input or in the base, OO-ANCHOR(AFFIXT,R) is not violated in any of the candidates. Failure of associating \( \text{\L} \) as in candidate (a) violates MAXFLOAT. If \( \text{\L} \) associates to the H-toned stem, this creates a derived contour tone and violates *DIFFAL\(_\alpha\) (candidate (b)). The winner is is candidate (c) where \( \text{\L} \) has overridden the H stem. In tableau (10), the base is also suffixless and OO-ANCHOR(AFFIXT,R) is not violated. The winner is candidate (c) where \( \text{\L} \) has associated to the toneless -ni. The most interesting pattern is derived in tableau (11). The input is the H-toned stem ‘wild goose’ with the toneless plural suffix -ni + \( \text{\L} \). Crucially, the base form here, the nominative plural, has the suffix...
-nì. The undominated constraint OO-ANCHOR(AFFIXT,r) demands that the rightmost affix tone (=the suffix) of each candidate must correspond to the H suffix tone of the base (nì). Candidates (c-d) violate this constraint as nì is L-toned or toneless. If both the H tone of the base affix and the L associate to nì as in candidate (b), DIFFAL, is violated. Candidate (a) is therefore the winner where -nì is H-toned as in the base and L has failed to associate remaining floating.

(1) dòól
‘boy’

(2) Oblique case: L
run dòól
age boy, GEN, SG
‘the age of the boy’

(3) Tone patterns in oblique case
<table>
<thead>
<tr>
<th>Group</th>
<th>Nominate case</th>
<th>Obliq case</th>
<th>#</th>
<th>Gloss</th>
</tr>
</thead>
<tbody>
<tr>
<td>i. H</td>
<td>L dòól</td>
<td>L dòól</td>
<td>SG</td>
<td>‘boy’</td>
</tr>
<tr>
<td>ii. L</td>
<td>L tòt</td>
<td>L tòt</td>
<td>SG</td>
<td>‘summer’</td>
</tr>
<tr>
<td>iii.</td>
<td>L dëčl</td>
<td>L dëčl</td>
<td>PL</td>
<td>‘sheep’</td>
</tr>
<tr>
<td>(a)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>i. H</td>
<td>L nòop</td>
<td>L-L nòop-nì</td>
<td>PL</td>
<td>‘messages’</td>
</tr>
<tr>
<td>ii. H</td>
<td>tët</td>
<td>H-L tët-nì</td>
<td>PL</td>
<td>‘hands’</td>
</tr>
<tr>
<td>(b)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(4) a. nì: [PL ]
b. nì: [PL, NOMINATIVE]
c. تدخل [OBLIQUE CASE]

(5) Oblique: Faithfulness to nominative PL

<table>
<thead>
<tr>
<th>PL Nom</th>
<th>Obl PL</th>
<th>Gloss</th>
</tr>
</thead>
<tbody>
<tr>
<td>L-H</td>
<td>kòor-i</td>
<td>line</td>
</tr>
<tr>
<td>L-H</td>
<td>tòk-nì</td>
<td>‘coconut fruit’</td>
</tr>
<tr>
<td>L-H</td>
<td>dëč-nì</td>
<td>‘soldier’</td>
</tr>
<tr>
<td>H-H</td>
<td>tùst-nì</td>
<td>‘wild goose’</td>
</tr>
</tbody>
</table>

(6) Nominative plural is the base form in Nuer.

(7) *DiffALσ Assign a violation mark for tones associated to the same σ through different association line types (±epenthetic) (Zimmermann 2015)

(8) OO-ANCHOR (AFFIXTONE,R) ⇒ HAVE-T ⇒ *DIFFALσ ⇒ MAXFLOAT ⇒ MAX-T σ


<table>
<thead>
<tr>
<th>[dòól] in pat: /dòólتدخل/</th>
<th>OO-ANCHOR(AFT,R)</th>
<th>HAVE-T</th>
<th>*DIFFALσ</th>
<th>MAXFL</th>
<th>MAXTσ</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. dòól</td>
<td></td>
<td></td>
<td>*!</td>
<td></td>
<td></td>
</tr>
<tr>
<td>b. dòól</td>
<td></td>
<td></td>
<td>*!</td>
<td></td>
<td></td>
</tr>
<tr>
<td>c. تدخل dòól</td>
<td></td>
<td></td>
<td>*!</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>


<table>
<thead>
<tr>
<th>[tët-nì] in pat: /tët+nìتدخل/</th>
<th>OO-ANCHOR(AFT,R)</th>
<th>HAVE-T</th>
<th>*DIFFALσ</th>
<th>MAXFL</th>
<th>MAXTσ</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. tët-nì</td>
<td></td>
<td>*!</td>
<td>*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>b. tët-nì</td>
<td></td>
<td>*!</td>
<td>*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>c. تدخل tët-nì</td>
<td></td>
<td>*!</td>
<td>*</td>
<td></td>
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</tbody>
</table>


<table>
<thead>
<tr>
<th>[tùst-nì] in pat: /tùst-nìتدخل/</th>
<th>OO-ANCHOR(AFT,R)</th>
<th>HAVE-T</th>
<th>*DIFFALσ</th>
<th>MAXFL</th>
<th>MAXTσ</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. تدخل tùst-nì</td>
<td></td>
<td>*!</td>
<td>*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>b. tùst-nì</td>
<td></td>
<td>*!</td>
<td>*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>c. tùst-nì</td>
<td></td>
<td></td>
<td>*</td>
<td></td>
<td></td>
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<tr>
<td>d. tùst-nì</td>
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</tr>
</tbody>
</table>
References
Pyrrhic Feet

A number of languages have phonological patterns that require headless (pyrrhic) feet, pairs of moras or syllables without stress (Hayes 1987; Tyhurst 1987; Hung 1993, 1994; Selkirk 1995; Crowhurst 1996; Hyde 2002). Their usefulness as a descriptive device is generally known but they are difficult to reconcile with current conceptions of feet. The clearest evidence for stressless feet comes from Japanese, which has very clear bimoraic feet that lack stress entirely (Poser 1990), and from languages like Seminole/Creek (Halle & Vergnaud 1987) and Cairene Arabic (McCarthy 1979), where stressless feet are needed as counting devices to position main stress. I argue here for disentangling stress from feet so that feet emerge from constraint interaction rather than stipulation (van de Vijver 1998). FTBIN gives us the basic fact of a foot—(µµ) or (σσ)—so all that's needed for iambs and trochees is stress. I replace RHTYPE-T and RHTYPE-I (Prince & Smolensky 1993) with the following: NOIAMB: No foot has final stress. NOTROCHEE: No foot has initial stress. Pyrrhic feet arise under FTBIN and PARSE-σ when NOIAMB and NOTROCHEE are undominated:

<table>
<thead>
<tr>
<th>Japanese: suSi</th>
<th>Nolamb</th>
<th>NoTrochee</th>
</tr>
</thead>
<tbody>
<tr>
<td>(suSi)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(’suSi)</td>
<td></td>
<td>*</td>
</tr>
<tr>
<td>(suʃi)</td>
<td>*</td>
<td></td>
</tr>
<tr>
<td>(’suʃi)</td>
<td>*</td>
<td>*</td>
</tr>
</tbody>
</table>

The factorial typology (Prince & Smolensky 1993) that emerges from NOIAMB and NOTROCHEE produces just three kinds of foot: iamb, trochee, and pyrrhic.

- Trochee (x.) NOIAMB, NOLAPSE > NOTROCHEE
- Iamb (.X) NOTROCHEE, NOLAPSE > NOIAMB
- Pyrrhic (..) NOIAMB, NOTROCHEE > NOLAPSE

The spondee (xx), which occurs in no known language, is harmonically bounded on this analysis by (x.), (.X) and (..) and cannot surface under any constraint ranking. It is excluded here without stipulation. This produces the following symmetrical (Kager 1993) system of feet:

- Trochee
- Iamb
- Pyrrhic

Moraic  
(Latin, Eskimo, Japanese)

Syllabic  
(Saami, Osage, Shanghai)

All of the types above but the last are secure (see Altshuler 2009 for Osage); I argue that Dun-anmu's 1997 trochaic analysis of Shanghai Chinese is unmotivated with respect to stress and that it is better treated as a syllabic pyrrhic (σσ).
Deepthi Gopal & Stephen Nichols

Sonorant-conditioned mid vowel lowering in Turkish

In Turkish, realisations of the front mid vowels /e ø/ are conditioned by the following coda, with sonorants lowering preceding vowels, as in (1).

(1) /ben/ [bæn] ‘I’ /dørt/ [dœrt] ‘four’
     /erdem/ [ær.dæm] ‘virtue’ /tørpy/ [tœr.py] ‘file’
     /beʃ/ [beʃ] ‘five’ /tʃøp/ [tʃøp] ‘rubbish’

Reports in the descriptive literature (e.g. Göksel & Kerslake 2005) do not address the generality and categoricity of this pattern. Vowel lowering in closed syllables or before a rhotic coda is widely attested (e.g. French, Catalan /e/ (Bradley 2010), Swedish /e/ and /ø/ (Riad 2014), Faroese /e/ (Árnason 1999), /ø/ in various Swiss German varieties (Keel 1982, Janda & Joseph 2001, inter alia)); however the Turkish case presented here is distinct as it generalises to all [+sonorant] finals.

Our (ongoing) experimentation samples 7 female and 2 male Turkish speakers, all resident in the UK at the time of consultation. Two age ranges were represented: those clustered around 35 (range 31-38) and those clustered around 20. Speakers read a list of 190 items in isolation, and 35 sentences containing tokens of /e ø/ embedded in varied environments; F1, F2 (at the mid-point of the vowel) and duration were measured. Production data confirm that that speakers have two categorically distinct realisations of /e/ conditioned by the following coda (save a single speaker from far Eastern Turkey who shows some gradient lowering, especially before /r/, but no categoricity). /e/-realisations preceding a coda sonorant do not overlap with those in other environments. No speakers show predictable lowering of /ø/; the state of /ø/ is more variable, however. For some speakers /e/ is the only target of pre-sonorant lowering; for some others, a significant effect in /ø/ can be seen (e.g.(1)), though categoricity is less convincing. For the youngest speakers, /ø/ appears to be categorically lowered (Fig.3). /ø/-lowering is most significant before coda /r/; this may partly be an effect of relative lexical frequency but might also indicate that pre-rhotic lowering is the phonetic precursor to this change.

Across all environments, the following (gradient) generalisation holds: F1(obstruent) < F1(open) < F1(sonorant), i.e. pre-obstruent /e/ are highest, pre-sonorant /e/ are lowest. This is distinct from the ordering that we see for /ø/ for our older group (Fig.2), for which F1(open) < < F1(obstruent, sonorant). For younger speakers (Fig.3), it seems that the ordering for /ø/ is converging towards the ordering for /e/. Younger speakers seem to show categoricity in /ø/-lowering, tighter clustering in the obstruent-open-sonorant split in /e/ and much more overlap between lowered /e/ and /ø/.

We see two sets of apparent exceptions to the /e/-lowering rule. In a few very high-frequency items (determined as per the Turkish National Corpus, Aksan et al 2012), we see some optionality, entirely absent from any lower-frequency items not governed by other exceptions: kendi ‘myself’ [kæn.di] ~ [ken.di], önemli ‘important’ [ø.nem.li] ~ [ø.næm.li]. Second, independent of
frequency, /e/ in word-initial sonorant-coda syllables resists lowering, but only in a word of sufficient size (trisyllabic or larger): [el.bi.se] ‘dress’, [jem.si.je] ‘umbrella’. Affixation does not affect this exceptionality in either direction, suggesting that we do not have a straightforward case of positional faithfulness; exceptional items remain exceptional under affixation, and non-exceptional items remain non-exceptional.

This seems to be a clear and traceable change in progress. In the apparent initial system, the front mid vowels are highest in open syllables; in the final system, pre-obstruent vowels are highest and pre-sonorant vowels are lowest, with /e/ ahead of /ø/ for all speakers. Speakers at an ‘intermediate’ stage in the change show a small separation between the pre-rhotic context and other sonorant contexts, suggesting a possible rhotic precursor; younger speakers show unequal (in magnitude) but seemingly opposed pre-obstruent raising, which we propose may indicate an avoidance of the established lowering, due to anti-similarity between the pre-obstruent environment and the canonical targets of the process.

Figure 1: F1 and F2 plots for 5 participants aged 31–38 (mean 34), Lobanov-normalised, shown with 95% confidence ellipses. Note that /e/ clustering by coda type is visible.

Figure 2: Histograms of normalised F1 for /e/, /ø/, for 5 participants aged 31–38.
Figure 3: F1 and F2 (non-normalised) for /e/ (left), /a/ (right), for one speaker aged 20. Note that the pattern in /a/ appears to be converging with the well-established pattern in /e/.

References
Laurentian French laxing harmony and the Activity Principle

The Activity Principle Theories of contrastive specification in phonology, to the extent that they make empirical predictions, adopt some version of what Dresher (2015, 2016) calls the Activity Principle: features identified as contrastive are those that “are relevant to the phonological computation.” In its strongest interpretation, the Activity Principle predicts that only contrastive features should be visible to phonological operations; redundant features, though implemented phonetically, are unable to spread, to block spreading, or to condition the application of phonological processes.

Lax high vowels in Laurentian French Laxing harmony in Laurentian French, described in detail by Walker (1984) and Poliquin (2006), presents an apparent challenge to the strongest version of the Activity Principle. The high vowels /i y u/ are predictably lax [IYU] in final syllables closed by any consonant other than the voiced fricatives /v z ʒ ɥ/. Although this laxing is predictable, a lax high vowel in the final syllable triggers harmonic laxing of other high vowels earlier in the word, as in (1). In addition to harmony, Poliquin (2006: 97) describes optional dissimilatory laxing in disyllabic words with two underlyingly identical high vowels in open syllables: e.g., midi is optionally [mi.dzi] instead of [mi.dzi]. Reconciling the two As there is no underlying contrast between tense and lax high vowels, the phonological propagation of laxness from one high vowel to another seems to defy the Activity Principle. Nor can the Activity Principle be appeased by positing that closed-syllable laxing and laxing harmony involve the spreading of some contrastive feature from the final coda consonant to the vowel of the final syllable, and thence to other high vowels: dissimilatory laxing shows that the relevant feature is phonologically active even when high vowels are the only segments involved. The answer, I propose, lies in the contrastive scope of the feature [±tense]. Although high /i y u/ do not contrast with minimally different underlying lax counterparts, the tense–lax distinction is contrastive in the French vowel system more generally: mid /e ø o/ contrast (albeit marginally) with /ɛ œ ɔ/, and Jakobson & Lotz (1949) take the contrast between /a/ and /a/ to involve the same feature. If [±tense] has wider scope than [±high] in the contrastive hierarchy, as in Fig. 1, then it will be contrastively specified on /i y u/ as the feature that distinguishes them (and /a e ø o/) from /ɛ œ ɔ/. Because [±high] is also specified on /i y u/ (distinguishing them from /e ø o/), laxing does not make /i y u/ featurally identical to any underlying lax vowel; rather, it produces a combination of contrastive feature values [+high, ±tense] not present in the underlying inventory. [±tense] can then propagate from a high vowel in a final closed syllable to other high vowels as per Poliquin. Binaarity and coalescence Fig. 1 builds on proposals by Jakobson & Lotz (1949), Burstynsky (1968), and St-Amand (2012), and finds independent support in their analyses of other phenomena. St-Amand gives wide scope to the tense–lax contrast as part of an account of coalescence in hiatus resolution. However, Fig. 1 uses binary features, while
St-Amand uses privative ones. The laxing facts imply binary $[\pm \text{tense}]$: if the relevant feature were privative Tense, then closed-syllable laxing would delink Tense, and harmony would have to copy the absence of a feature. If the marked value were Lax, it would be absent on high vowels underlingly, which would make it hard to motivate dissimilatory laxing as an OCP effect, and harmony would have to spread an inserted feature. St-Amand’s case for privative features rests on the assumption that there is no tense–lax contrast in the low vowels. She argues that under either hierarchical ordering of $[\pm \text{ATR}]$ and $[\pm \text{low}]$, coalescence of /ae/ to [ɛ] would introduce a feature not present on either of the input vowels: either $[\pm \text{ATR}]$ would be unspecified on /a/ (Fig. 2a), or $[\pm \text{low}]$ would be unspecified on /e/ (Fig. 2b). Analyzing the /a/-/o/ contrast as one of tenseness (Jakobson & Lotz 1949) removes this problem (/a/ is $[\pm \text{tense}]$ in Fig. 1), and accounts for parallels in the distributional patterns of /a/-/o/ and /ɛ œ o/-/ɛ ø o/.

**Figure 1:** Proposed contrastive feature hierarchy for French vowels

**Figure 2:** Ordering binary $[\pm \text{low}]$ and $[\pm \text{ATR}]$ (St-Amand 2012: 69)
References
Conflicting demands of complex timing patterns in Essential Tremor patients: When the realisation of a phonological constituent breaks down

Chronic deep brain stimulation (DBS) of the nucleus ventralis intermedius (VIM) is an effective treatment for patients with medication-resistant Essential Tremor (ET). However, these patients report that the stimulation has a deleterious effect on their speech (cf. Flora et al. 2010, Mücke et al. 2014, Pützer et al. 2007). The present study investigates the articular timing in ET patients with and without stimulation as well as for healthy control speakers.

We recorded 12 ET patients treated with deep brain stimulation in stimulation-ON and stimulation-OFF as well as 12 age-matched healthy controls (German speakers) with a 3-D Electromagnetic Articulograph. Sensors were placed on upper and lower lips, tongue tip and tongue dorsum. We used a sentence production task and included target words varying from low to high complexity, such as <Lima> /lima/ (capital of Peru) and <Pina> /pina/ (proper name) with simple onset (CV) and <Klima> /klima/ (‘climate’) and <Plina> /plina/ (nonce) with complex onsets (CCV) embedded in carrier sentences such as “Er hat wieder ____ gesagt” (‘He said ____ again’). We labelled gestural landmarks of C and V gestures, i.e. onset, peak velocity and maximum target. We analysed gestural coordination patterns within the coupling hypothesis of syllable structure (Browman & Goldstein 2000; Nam et al. 2009) and calculated the temporal intervals between the gestural onsets and targets of C and V gestures, i.e. CV lag and CC lag as well as Rightward and Leftward Shift. It is assumed that in a CV syllable C and V are coupled in-phase, leading to a simultaneous initiation of the C and the V gesture, resulting in a CV lag which is zero. In CCV syllables, where a more complex competitive coupling structure is assumed, both Cs are coupled in-phase with V and at the same time in anti-phase with each other, leading to a sequential activation of the consonantal gestures (measured in CC lag) and shift of the leftmost C away from the V and a shift of the rightmost C towards the vowel.

Results reveal that ET patients show a timing deficit in the phonetic realisation of syllables with a high level of complexity such as /kli/ and /pli/, indicating a lack of complex coupling relations (non-innate, learnt) between movements of the tongue tip, tongue dorsum and lips. Fig. 1 exemplifies the coordination pattern in /li/ (CV) versus /kli/ (CCV) for one ET patient with stimulation-ON. The figure shows the averaged trajectories (incl. repetitions) for CV and CCV; the trajectories in the display the tongue tip closure, and the trajectories below show the movement of the tongue dorsum. In /li/, the C and the V gestures show a synchronous pattern of activation, i.e. initiated at the same time (Fig. 1, left: CV lag around zero). This pattern reflects the underlying coupling structure: in CV syllables, C and V are coupled in-phase. Thus, there are no deficits in the realisation of syllables with a low level of complexity, indicating that the simple, innate pattern is still available. However, /kli/ fails to show the expected timing pattern. Due to a competitive coupling structure in CCV, there should be an activation delay between the two consonants. This is not the case, the CC lags are also around zero, i.e. the Cs are activated at the same time and thus not
sequentially. This indicates that ET patients show timing deficits in realizing complex coordination structures (Fig. 1, right). In order to compensate for these deficits, the gestural activation interval for /l/ is considerably stretched (see Fig. 1: /l/ in /kli/).

The overall results reveal stimulation-induced effects on the regulation in speech motor control in ET patients. We found timing deficits in the phonetic realization of competing coupling relations for complex onsets in the ET patients. While for syllables with high complexity, a delay would have been expected between the activation of both initial C gestures in the speech of ET patients. However, both C gestures are activated at the same time. We discuss how much timing variability is tolerated in a phonological system before the system becomes instable and patterns of syllable organisation break down.

References


Phonetic invariance in L2 modulates allophonic realizations in L1: Evidence from bilingual production of laterals

Language-specific variation of laterals has been shown to have consequences for bilinguals if their respective languages employ distinct realizations. For example, Barlow (2014) shows that Spanish learners successfully adapt to the allophonic patterns of English albeit diverging from the native English speakers in their production of laterals. Importantly, the allophonic pattern acquired in their L2 also influenced their L1 Spanish, as shown by the phonetic properties of their Spanish laterals. In particular, the bilinguals produced word-final laterals with a lower $F2$ than word-initial laterals. As in many other studies on L1 phonological attrition, however, the directionality of cross-linguistic influence largely remains understudied in the realization of laterals in bilinguals.

Here, we address this gap by exploring the reverse situation, that is, the consequence of having acquired an L2 that shows no variation in the realization of the lateral phoneme for the L1 that exhibits variable realization of the same category. In particular, we investigated 1) whether the L1 allophonic distribution can be suppressed in the acquisition of an L2 lateral phoneme that does not show an allophonic split, 2) whether the pattern acquired in the L2 has an effect on the allophonic realization of the L1 lateral, and 3) whether bilinguals’ productions of laterals in both of the languages in question are phonetically different from monolinguals.

In a production experiment, we tested onset and coda laterals in twelve American-German late bilinguals (mean LoR=25 years) who performed a reading task in English and in German. Additionally, American English monolingual and German monolingual control groups performed the same task. While many varieties of German feature a clear /l/ in all positions, English is generally considered to feature a clear variant in onset position, and a dark variant in coda position. This distinction is rather unclear for American English although it has been claimed that the precise realization of /l/ is gradiently modulated by syllable position (e.g. Hayes, 2000), displaying an allophonic pattern. Thus, our test items differed 1) in the position of the lateral (initial/final) and 2) the vowel environment, both of which are known to correlate with $F2$ values in English. We measured $F1$ and $F2$ at multiple time points as well as the $F2$ minima and maxima within the laterals in the experimental tokens and modeled potential differences between groups by converting raw Hertz values to Bark and fitting linear mixed effect models.

Preliminary results of a Z2-Z1 comparison for our monolingual participants suggest that German monolinguals produce laterals with identical qualities regardless of position in the syllable and vowel environment, confirming previous observations of the invariant nature of the German lateral. As expected, American monolinguals are sensitive to position as well as vowel environment, producing final laterals with a lower Z2-Z1 difference in coda position. The same com-
Comparisons for the bilingual participants reveal that they are sensitive to the position of the lateral in both of their languages, producing final laterals with a significantly lower Z2-Z1 distance than initial laterals just like their monolingual American English counterparts, albeit with significantly different values in word-initial position. Their German productions however differ significantly from German monolinguals in the final position but not in the initial position (see Figure 1).

We take our results to show that both the acquisition of novel phonetic realizations of existing phonemic categories as well as the precise phonetic realizations of the same categories in the L1 are vulnerable in bilinguals. In contrast, we find no evidence for transfer of the allophonic rule. Thus, cross-language influence in the phonetics of laterals appears to be bidirectional, whereas rule transfer of allophonic patterns is uni-directional.

**Figure 1:**
Boxplot of the Z2-Z1 difference between the bilinguals and the monolingual groups for word-initial and word-final laterals.
References
Hui-Chuan Huang

Matu’uwal (Mayrinax) Atayal Vowel Syncope

Matu’uwal Atayal (i.e. Mayrinax; Austronesian, Taiwan) is generally considered to be a very conservative Atayal dialect in that it preserves the distinction between male and female forms of speech (Li 1982), and it lacks the rich consonantal alternations found in the Squiliq dialect of Atayal (Li 1980). However, Matu’uwal exhibits intriguing patterns of vowel syncope which has so far been neglected in the literature. Based on fieldwork data, the paper unravels the generalizations in Matu’uwal vowel syncope, showing that the complicated patterns can be clarified in light of the diachronic development of schwa in proto-languages. The paper observes that a set of alternating vowels is attributed to the different realizations of the historical schwa in different positions within a word, and argues that these vowels are represented as empty vowel slots in the lexical representations in the synchronic phonology of the language. Adopting the idea of empty vowels allows the proposed analysis to show that Matu’uwal manifests rhythmic vowel deletion under right-to-left iambic metrification, which can be straightforwardly analyzed in Harmonic Serialism (McCarthy 2007), filling a typological gap of metrically conditioned syncope (right-to-left iambs) not discussed in McCarthy (2008).

A close examination of Matu’uwal data shows that some vowels alternate among [i, u, a, a/ɪ] and zero in the paradigm. The data of vowel alternations are classified into four types as illustrated in (1) to (4), based on the occurrences of the empty vowels. In Matu’uwal, phonemic vowels include /i, u, a/, stress falls on the final syllable, and complex syllable margins are not permitted. (Underlining ‘_’ in the angle brackets indicate deleted vowels.)

(4)  
\[
\begin{align*}
\text{a} & \quad \text{‘weave (fem)’: tinun, t<um>\text{inun, tinun-un, tinun-i, tinun-ani} } \\
\text{b} & \quad \text{‘do’: kabalaj, si-kabalaj, kabalaj-un~kabalaj-un, kabalaj-ani [kab_.la.ja.ni]} \\
\text{c} & \quad \text{‘cook (rice)’: g<um>hahapuj, gahpuj-ani [yah_.pu.ja.ni]}
\end{align*}
\]

(5)  
\[
\begin{align*}
\text{a} & \quad \text{‘cook (fem)’: t<um>aluk, si-taluk, talk-i [tal_.ki], talak-ani~talak-ani } \\
\text{b} & \quad \text{‘waste’: h<um>ikum, hikm-un [hik_.mun], hikm-i [hik_.mi], hikam-ani}
\end{align*}
\]

(6)  
\[
\begin{align*}
\text{a} & \quad \text{‘throw’ cbu’ [tşiɪu?], c<um>bu’ [tsum_.b̥u?], si-cbu’ [ɕɪts_.b̥u?], cbu’ani [tściɪu?ani]} \\
\text{b} & \quad \text{‘put’: s<um>ku’ [sum_.ku?], si-ku’ [ɕiś_.ku?], suku’-an [suku?an], suku’-aw}
\end{align*}
\]

(7)  
\[
\begin{align*}
\text{a} & \quad \text{‘follow’: galug, g<um>lug, g<in>lug, si-glug [ɕiɣ_.l̥u̇ŋ], pa-galg-un [pa yal_yan]} \\
\text{b} & \quad \text{‘complete’: naqru’ [naq_.ru?], naqar’-i [na.qar_.?i], naq ra’-ani [naq.ra_.?a.ni]}
\end{align*}
\]

Given the observation in Li (1981) that Proto-Austronesian schwa became *u in word-final syllables in Proto-Atayalic (which comprises Atayal and Seediq), a clear generalization emerges in the Matu’uwal data as long as we assume that the alternating vowel, which reflects historical schwa, still retains a timing slot in the input. With right-to-left iambic metrification, even-numbered syllables from the right edge appear in the nonhead position of a foot and are thus subject to deletion (or weakening). A twist in the Matu’uwal data is that while rhythmic syncope affects all vowels in
secondary feet, syncope in the main foot is quality-sensitive; only weak vowels are deleted in the primary foot.

References
Manami Hirayama & Timothy J. Vance

Onset Cy clusters in Japanese: Evidence from vowel devoicing

Japanese has contrasts between onsets romanized as singletons and Cy clusters (e.g., kaku ‘nucleus’ vs. kyaku ‘guest’, ponpon ‘tum-tum’ vs. pyonpyon ‘hop-hop’). It is uncertain whether Cy should be treated as a distinctively palatalized consonant or as a /Cy/ cluster; the phonetic realization is compatible with either analysis. In kyaku [kjaku], the [j] between [k] and [a] can be interpreted either as a realization of a separate segment /y/ or as just a transition from palatalized /kj/ to the following vowel. A distributional argument in favor of the /Cy/ analysis notes the neutralization of the contrast before front vowels: Ci, Ce, *Cyi, *Cye. On the cluster analysis, the absence of */Cyi/ and */Cye/ follows automatically from the phonotactic inadmissibility of */yi/ and */ye/ (Vance and Matsugu 2008).

High vowel devoicing is a source of phonetic evidence that might bear on this question of phonemic analysis. In Tokyo Japanese, a short high vowel surrounded by voiceless consonants typically devoices (Tsuchida 1997). If the initial and final C in CyuC both represent voiceless consonants, a reasonable expectation would be that voiceless /C/ would promote devoicing, whereas the voiced /y/ in /Cy/ would inhibit it. Of course, since Japanese has no /C/ vs. /Cy/ contrast, there is no impediment to realizing a phonemic /Cy/ cluster postlexically as a palatalized consonant [Cj]. Thus, since vowel devoicing is also a postlexical process (Hirayama 2009), equal devoicing rates for CuC and CyuC can be taken as consistent with either /CyuC/ or /CjuC/. However, a lower devoicing rate for CyuC than for CuC is consistent with /CyuC/ but hard to reconcile with /CjuC/. This paper reports an experiment that tests the hypothesis that the two devoicing rates are different. The results favor /CyuC/ over /CjuC/.

The test words included two onset types (C vs. Cy), three places of articulation (p, t, k) for both C and Cy, and two vowels (i, u, with i for the plain onset only), followed by ta. The syllable ma either preceded or followed C(y)Vta (e.g., mapyuta, kyutama, mahuta, hitama). To get a baseline, words with non-devoicing environments were also recorded; these words contained the same sequences as above but had da instead of ta (e.g., mapyuda). The recorded words were almost all nonsense words, due to the sparse occurrence of relevant forms in the existing vocabulary, but we included two actual words (kyupura, rapyuta) along with their Ci and Cu counterparts (e.g., kipura, raputa). Words were put in a carrier phrase and read by 14 speakers (10 from Kansai (Kyoto/Osaka) and 4 from Tokyo) 8 times. The accent was put on the first syllable. After removing 15 mispronunciations, 4,689 tokens were left for analysis.

Overall, of the 2,681 test words (those with devoicing environments), 38% were devoiced (vs. 0.2% for those with non-devoicing environments). The breakdown according to onset type (C vs. Cy) is remarkable: after C (N=1,786), 44% of the devoiceable vowels were devoiced, whereas after Cy (N=895), 25% were devoiced.

In order to determine whether this difference is significant, a mixed-effects logistic regression analysis was performed with R (ver. 3.1.1) and the lme4 package. Onset type, speaker region, vowel position, target vowel (i vs. u), and preceding and following consonants were entered into
the model as predictors, and speaker and item were entered as random intercepts and slopes (for the onset type). There was no interaction found from the distributional analysis; vowels after Cy were always less frequently devoiced than those after C in each level of the factors. Table 1 shows that after controlling for other factors, the onset type has a significant effect on the devoicing rate: vowels after Cy onsets are less likely to devoice than those after C onsets. Since speaker region also has a significant effect, in the direction expected in the literature (Tokyo speakers devoice more (79%) than Kansai speakers (21%)), we performed mixed-effects logistic regression analyses for the two groups separately and found the same onset-type effect in both groups, as shown in Tables 2 and 3.

The results support the /Cy/ cluster analysis over the palatalized /Cj/ analysis for the Japanese onsets of the type in question.

<table>
<thead>
<tr>
<th>Factor</th>
<th>β-coefficient</th>
<th>z</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>-5.0281</td>
<td>-5.697</td>
<td>1.22e-08 ***</td>
</tr>
<tr>
<td>Onset: Cy (vs. C)</td>
<td>-1.4734</td>
<td>-3.985</td>
<td>6.76e-05 ***</td>
</tr>
<tr>
<td>Speaker region: Tokyo (vs. Kansai)</td>
<td>5.3360</td>
<td>4.568</td>
<td>4.93e-06 ***</td>
</tr>
<tr>
<td>Vowel position: second (vs. first)</td>
<td>0.9853</td>
<td>3.767</td>
<td>0.000165 ***</td>
</tr>
<tr>
<td>Vowel: u (vs. i)</td>
<td>-1.0454</td>
<td>-2.413</td>
<td>0.015801 *</td>
</tr>
<tr>
<td>Preceding consonant: k (vs. h)</td>
<td>1.0862</td>
<td>3.736</td>
<td>0.000187 ***</td>
</tr>
<tr>
<td>Preceding consonant: p (vs. h)</td>
<td>-0.1202</td>
<td>-0.431</td>
<td>0.666338</td>
</tr>
<tr>
<td>Following consonant: t (vs. p)</td>
<td>3.2545</td>
<td>6.783</td>
<td>1.18e-11 ***</td>
</tr>
</tbody>
</table>

Table 2 Results of a mixed-effects logistic regression analysis: Tokyo speakers only

<table>
<thead>
<tr>
<th>Factor</th>
<th>β-coefficient</th>
<th>z</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>-0.6627</td>
<td>-0.473</td>
<td>0.6363</td>
</tr>
<tr>
<td>Onset: Cy (vs. C)</td>
<td>-2.1406</td>
<td>-2.322</td>
<td>0.0202  *</td>
</tr>
<tr>
<td>Vowel position: second (vs. first)</td>
<td>5.3717</td>
<td>7.041</td>
<td>1.90e-12 ***</td>
</tr>
<tr>
<td>Vowel: u (vs. i)</td>
<td>-0.7692</td>
<td>-1.541</td>
<td>0.1233</td>
</tr>
<tr>
<td>Preceding consonant: k (vs. h)</td>
<td>0.9959</td>
<td>1.899</td>
<td>0.0576</td>
</tr>
<tr>
<td>Preceding consonant: p (vs. h)</td>
<td>-0.3591</td>
<td>-0.774</td>
<td>0.4387</td>
</tr>
<tr>
<td>Following consonant: t (vs. p)</td>
<td>3.2565</td>
<td>5.152</td>
<td>2.58e-07 ***</td>
</tr>
</tbody>
</table>

Table 3 Results of a mixed-effects logistic regression analysis: Kansai speakers only

<table>
<thead>
<tr>
<th>Factor</th>
<th>β-coefficient</th>
<th>z</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>-4.3497</td>
<td>-4.938</td>
<td>7.89e-07 ***</td>
</tr>
<tr>
<td>Onset: Cy (vs. C)</td>
<td>-1.5296</td>
<td>-3.639</td>
<td>0.000274 ***</td>
</tr>
<tr>
<td>Vowel position: second (vs. first)</td>
<td>-0.6224</td>
<td>-1.941</td>
<td>0.052241</td>
</tr>
<tr>
<td>Vowel: u (vs. i)</td>
<td>-1.1268</td>
<td>-3.597</td>
<td>0.000321 ***</td>
</tr>
<tr>
<td>Preceding consonant: k (vs. h)</td>
<td>1.3190</td>
<td>3.980</td>
<td>6.90e-05 ***</td>
</tr>
<tr>
<td>Preceding consonant: p (vs. h)</td>
<td>-0.3244</td>
<td>-0.991</td>
<td>0.321803</td>
</tr>
<tr>
<td>Following consonant: t (vs. p)</td>
<td>3.5563</td>
<td>6.780</td>
<td>1.21e-11 ***</td>
</tr>
</tbody>
</table>
References
Hironori Katsuda

Tonal alignment features in Orkney and Shetland dialects

This study summarizes the results of a pilot analysis exploring the intonational phonology of the Orkney and Shetland dialects in Scotland, where analyses of intonational features have so far been restricted to phonetic descriptions of a few words (Van Leyden & Van Heuven, 2006). It identifies typically-used tunes and their alignment features in each dialect, based on the recording of a word list (163 words consisting of both monosyllabic and polysyllabic words), read material, and spontaneous speech.

We analyze the typical tunes of Orkney and Shetland for LH and LHL, respectively, and these tunes are realized based on the stressed syllables of most content words in an utterance, spreading from the stressed syllable to the unstressed syllables immediately preceding the next stressed syllable, or to the utterance-final syllable.

Regarding tonal alignment patterns, examining monosyllabic words reveals that these tunes are only realized on vowels or sonorant consonants. In Orkney, CVC[+son] words are realized with the first L tone on the vowel and the second H tone on the sonorant consonant, while CVC[-son] words are realized with the two tones only on the vowel. In Shetland, on the other hand, CVC[+son] words are realized with the last L tone on the final sonorant and the first two LH tones compressed in the vowel, while CVC[-son] words are realized only with the first two tones compressed in the vowel.

The abovementioned features are considered to be reflecting the syllable structures of each dialect. In Orkney, only vowels and sonorant consonants can occupy a mora position, so in the case of CVC[-son] words, the vowel takes up two mora positions, causing possible lengthening of the vowel. In contrast, Shetland allows obstruents to occupy mora positions, which makes the vowel short due to closed syllable shortening (Kaye, 1990) (Figure 1) and carry only the first two LH tones instead of the three.

Furthermore, examining polysyllabic words reveals that the speakers’ Tone Bearing Unit (TBU) varies for both Orkney and Shetland dialects. Some take moras, while others take syllables as TBU. In Orkney, this difference is reflected in the interpolation patterns between the two tones. For the Shetland dialect, we assume the stress to weight principle (Prince, 1990) applies, such as in the cases of several Scandinavian varieties (Riad, 1995), whereby the stressed syllable must be bimoraic. The mora-based speakers always realize the first two LH tones in the stressed syllable (Figure 2), while the syllable-based speakers basically pronounce each tone in each syllable (Figure 3). This study argues that tonal alignment patterns of intonation contours are determined by the language-specific combination of several factors, such as stress, sonority, and duration, as those of tone languages are analyzed so (Zhang, 2004; Gordon, 2004).
References


Zhang, J. (2004). The role of contrast-specific and language-specific phonetics in contour tone distribution. In B. Hayes, R. Kirchner, & D. Steriade (Eds.), Phonetically Based Phonology.
(pp. 157-190). Cambridge: Cambridge University Press.
On the basis of four case studies, I will discuss the influence of the three rhythmic constraints in (1) on the morphophonology of German. It will be shown that i. all three constraints condition the prosodic shape of words (I and II below), and ii. that their influence is not confined by word boundaries; instead, the choice of allomorphs is also affected by the prosodic structure of adjacent words (III and IV below).

I. Several stress patterns in German complex words are motivated by \( ^*\text{CLASH} \) and \( ^*\text{LAPSE} \): Clash avoidance may lead to stress shift (as in natión+ál → nàtionál); \( ^*\text{LAPSE} \) can be made responsible for the (opaque) formation of demonyms in certain dialects (2),(3).

II. Rhyme and ablaut reduplication: the data in (4) (Kentner, accepted) corroborate the findings by Wiese & Speyer (2015) and Wiese (2016) who make the case for prosodic parallelism. In these forms (which are often used as nicknames), base and reduplicant obey a strict non-identity requirement, guaranteed by rhyme or ablaut. Crucially, however, the two morphs must not differ prosodically, that is w.r.t. branching (*Il.se+bils, *Frinz+fran.ze).

III. Coinages for musical genres from the website everynoise.com were examined. Besides simplex words (e.g. pixie), these coinages are either phrases (e.g. swedish metal), or compounds/blends (e.g. triphop). To ascertain the effect of PARALLELISM, all dyadic coinages (n=714) listed in everynoise.com were scrutinised. While the majority of these was nonparallel in nature (e.g. chicago house), the subset involving only native feet (monosyllables and trochees) as members of the dyad (n=498) did show a significant influence of PARALLELISM (z=2.611, p=0.009). Importantly, PARALLELISM appears to be effective both within complex words (pop rock) as well as beyond the word (swedish metal).

IV. Optional schwa: To ascertain the relative influence of the three rhythmic constraints in (1), the frequencies of the variable adverbs gern~gerne ("gladly"), selbst~selber ("him/herself"), and lang~lange ("long") were examined in the context of two forms of the verbs tun and machen ("to do"), respectively, creating six quadruplets of adverb-verb combinations. This way, eight conditions were devised in which the three rhythmic constraints were either violated or respected (see Table 1). For each combination of verb form and adverb, the corpus frequency (DeReKo) was determined. For all six quadruplets (verb form vs. foot structure of adverb, 2x2), chi-square tests revealed that the two factors are not independent (all p-values<0.001). To specifically test the effects of the three rhythmic constraints, mixed effects models were constructed with the standardized residual of the chisquare as dependent variable (cf. Figure 1), and verb and adverb as random effects. The full model with all three constraints as fixed factors yields significant effects for \( ^*\text{CLASH} \) and \( ^*\text{LAPSE} \) but not for PARALLEL. A likelihood ratio test demonstrates, that model fit does not deteriorate when discarding PARALLEL as fixed factor (chi-square=1.59, Df=1, p=0.207)
suggesting that *CLASH and *LAPSE suffice to explain the rhythmic aspect of the morphoprosodic alternation.

In sum, there is good evidence that all three constraints condition the morphophonology of German both within as well as beyond the word. The effect of PARALLELISM appears to be particularly evident in the case of names or coinages (which are relatively immune to further morphological processes); however, PARALLELISM may be superseded by *CLASH and *LAPSE in contexts that are more strongly affected by the morphosyntactic environment (IV).

I
(2) semi-transparent, with resyllabication (e.g. Bavarian, Upper Saxon)
München ~ Münch(*e)ner; Weiden ~ Weid(*e)ner; Bautzen ~ Bautz(*e)ner
(3) opaque, elision of stem-final consonant (Northern Low Saxon)
Bremen ~ Brem(*en)er; Emden ~ Emd(*en)er; Apen ~ Ap(*en)er

II
(4) a. Krimskrams, Frinzfranz, Tingeltangel, Mitzematze
b. Ilsebilse, Mannipanni, Popelmopel, Heinzipeinzi

Table 1: Bigrams scrutinized in corpus experiment and corresponding factors used for the evaluation of rhythmic effects.

<table>
<thead>
<tr>
<th>Bigram</th>
<th>PARALLEL</th>
<th>*CLASH</th>
<th>*LAPSE</th>
</tr>
</thead>
<tbody>
<tr>
<td>gern/lang/selbst tun</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>gerne/lange/selber tun</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>gern/lang/selbst getan</td>
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<td>✓</td>
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<tr>
<td>gerne/lange/selber getan</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>gern/lang/selbst machen</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>gerne/lange/selber gemacht</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>gern/lang/selbst gemacht</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>gerne/lange/selber gemacht</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
</tbody>
</table>
Figure 1: Standardized residuals for the two levels of each of the three factors.

References
Coda typology, the sonority myth, and positive markedness

While sonority and the sonority hierarchy (SH) have been debated extensively (e.g., contributions in Parker 2012) there hasn’t been any survey yet that systematically investigates how individual segment classes behave with respect to sonority across languages. It is taken as a given by most authors that syllable onsets favour low sonority consonants and that syllable codas favour high sonority consonants. Claims made on the role of sonority are usually made on the basis of data from very few languages. We investigate the organization of coda segmentism, focusing on the role of manner of articulation features, by examining over 200 languages from over 50 language families. According to Clements (1990) and many others, the inventory of segments in the coda universally observes the SH, with less sonorous segments in the coda of a CVC syllable implying the presence of the more sonorous ones. With the SH L>N>F>P (Liquids > Nasals > Fricatives > Plosives), the predicted coda inventories include solely {L}, {L,N}, {L,N,F} and {L,N,F,P}. Our database of 204 geographically and genetically widely diverse languages paints a different picture. In addition to languages with all four segment classes figuring in the coda, we document the restricted coda inventories in (1), in either word-medial or word-final codas, or in both. All languages with restricted coda inventories included in our sample have all four segment classes represented in their general segment inventory.


Out of the eight coda inventories in (1), only two conform to the sonority based predictions. Importantly, one of the predicted inventories, L, does not figure in our database, even though it should be particularly privileged from the perspective of sonority. In sum, sonority is not a reliable predictor of manner of articulation classes found in codas cross-linguistically. Several generalizations emerge from (1). First, the N class is privileged with respect to the L class, with L implying the presence of N. Second, the inventories that include sonorants, either N or L, N, co-occur with both F and P, that is, with both continuant and non-continuant obstruents. Finally, F and P do not co-occur within a restricted coda inventory. On the basis of our observed typology we can derive the system of relative markedness, shown in (2).

(2) a. The P-scale: *(F)/Coda, *(F,L)/Coda, *(F,L,N)/Coda
   b. The F-scale: *(P)/Coda, *(P,L)/Coda, *(P,L,N)/Coda

In the formal analysis we address the issue of whether some theory of contrastive features captures the typology in (1). The classes in (2) cannot be defined in standard features (SPE; Chomsky & Halle 1968 or UFT, Clements & Hume 1995). We can thus not define an appropriate set of negative markedness constraints, as those indicated in (2). However, if we allow for positive constraints of the type ADMIT(X) (‘Assign a violation for every coda that is not X’), as well as positive disjunctions of such constraints (‘Assign a violation for every coda that is not either X or Y’), the features [sonorant], [nasal] and [±continuant] account for the typology. The constraint definitions are given in (3) overleaf. The factorial typology was calculated with OTWorkplace (Prince, Tesar & Merchant) and generates exactly the attested patterns. It produces 13 languages though, which
all fall into the 9 surface patterns (PFNL included) and some differ in how they realize unfaithful segments when the inventory allows fewer than the four major categories. In conclusion, our typological survey shows that sonority plays at most a role in the crosslinguistic shaping of coda inventories, but only in the form of the feature [sonorant] and not in the way it was claimed in the literature. In addition, this typology shows that markedness constraints can take other forms than *X/position P, as usually assumed in the OT literature.

(3) Constraints

a. ADMIT[son]/Coda: Assign one violation mark for every segment in a coda that is not [sonorant].
b. ADMIT[nas]/Cd: Assign one violation mark for every segment in a coda that is not [nasal].
c. ADMIT[-cont]/Cd: Assign one violation mark for every segment in a coda that is not [-continuant].
d. ADMIT[+cont]/Cd: Assign one violation mark for every segment in a coda that is not [+continuant].
e. ADMIT[nas]\[-cont]/Cd: Assign one violation mark for every segment in a coda that is not either [nasal] or [-cont].
f. ADMIT[nas]\ [+cont]/Cd: Assign one violation mark for every segment in a coda that is not either [nasal] or [+cont].
g. ADMIT[son]\[-cont]/Cd: Assign one violation mark for every segment in a coda that is not either [son] or [-cont].
h. ADMIT[son]\ [+cont]/Cd: Assign one violation mark for every segment in a coda that is not either [nasal] or [+cont].
i. Faith: Assign one violation for every segment in a coda that is not mapped to itself.

References
Prince, Alan Bruce Tesar & Nazarré Merchant. OTWorkplace. https://sites.google.com/site/otworkplace/home
Frank Kügler

On pronouns and their prosodic phrasing in German

Pronouns are function words syntactically, and are commonly viewed as weak elements in prosodic constituency (Selkirk, 1996; Truckenbrodt, 2007). A pronoun constitutes a functional head without any complement, and thus the pronoun usually does not project a mapping constraint from syntactic to higher prosodic structure (Truckenbrodt, 2007; Bennett et al. 2015). For instance, compared to a full subject NP, which maps to a phonological phrase (\(\phi\)-phrase), a pronoun does not project a \(\phi\)-phrase boundary (cf. e.g. Chen, 1987 for Xiamen Chinese; Selkirk, 2011). Selkirk (1996, p. 188) lists two option of prosodic phrasing of function words: (i) either as a prosodic word (\(\omega\)), or (ii) as a prosodic clitic. The fact that function words may be phrased as a \(\omega\) shows the possibility of pronouns to receive prominence by pitch accent assignment since only full prosodic words may be associated with pitch accents. In languages such as English or German, the head of a \(\phi\)-phrase is realized as a pitch accent (e.g. Selkirk, 1995). Given this fact, a pronoun phrased as \(\omega\) may function as a head of a \(\phi\)-phrase. Recently, increasing evidence arises that function words, such as pronouns, have both weak and strong versions, and that strong functional elements are treated similar to lexical words in that they receive a pitch accent (Bennett et al. 2015).

This study is concerned with pronouns in German and their conditions for prosodic phrasing. We will explore the ability to carry an accent for different types of pronouns (monosyllabic personal pronouns such as ich, sie, ihm, es ‘I, she, him, it’ vs. polysyllabic indefinite pronouns such as irgendwer (wer), irgendwas (was) and jemand ‘someone, somewhat, somebody’). The presence or absence of a pitch accent is tested in different syntactic positions (sentence-initial, -medial, and -final) and for objects either as an argument or an adjunct. Ten German native speakers read about 50 different sentences each. Pronouns may either receive a full pitch accent, or receive less prominence being a generally weak prosodic element. Less prosodic prominence would lead to less prominent accent realizations by using less prominent accent types (cf. Baumann & Röhr, 2015). Alternatively, accents may be realized in a compressed pitch register and thus less prominent (cf. Kügler & Féry, 2016 for pitch accents on full argument NPs in compressed pitch register in postfocal position). The conditions for pronouns receiving a pitch accent or not, and the type of realization will be discussed in relation to their prosodic phrasing.

References


Anton Kukhto & Alexander Piperski

xuj-Reduplication in Russian

Russian exhibits a pattern of expressive echo reduplication in xuj(j): séltli-xéltli ‘selfie-RED’, startápy-xujápy ‘startups-RED’ with derogative / depreciative meaning. The word xuj ‘penis’ is strongly tabooed in Russian, and, for this reason, the phenomenon is rarely discussed in the Russian-speaking scientific community. It is telling that most papers mentioning this type of reduplication appeared in Russian Linguistics, a journal published outside Russia (Dreizin and Priestly 1982, Plähn 1987, Belikov 1990, Voinov 2012). The most extensive description of the pattern is provided by Belikov (1990):

1. if the base does not end in an open stressed syllable, its pretonic part is replaced with xuj- in the reduplicant (úlica-xujúlica ‘street-RED’, avtóbóbus-xujóbus ‘bus-RED’, tumán-xujián ‘fog-RED’);
2. if the base ends in an open stressed syllable, xue- is added to the last syllable of the base (osly-xuesly ‘donkeys-RED’).

These rules were inferred from introspection and disparate anecdotal examples. In order to test their validity on a large sample, we used the Araneum Russicum Maximum corpus of 13.7 billion tokens (Benko 2014). We ran a CQL query [lc=".*(.{1,})-xu.?\1"] , looking for hyphenated words whose first component contains (i) any substring of 0 or more characters and (ii) a substring of 1 or more characters repeated in the reduplicant after xu and possibly one more character. The query yielded 3,801 hits. After manually filtering out words like ˇcixua-xua ‘chihuahua’ or San-Xuan ‘San Juan’, which amount to more than 40% of results, we were left with 397 types and 439 tokens of xuj-reduplication. Among these 439 examples, there are 434 nouns, two verbs, one adverb, one pronoun and one question word.

Belikov’s rules are broadly confirmed with several exceptions that mostly involve repetition of the onset of the stressed syllable (profkóma-xujkóma ‘trade.union.GEN.SG-RED’ instead of the expected profkóma-xujkóma, which in this case might be due to the fact that profkom is a compound itself). However, words with ultimate stress show substantial variation. Out of 15 non-monsyllabic ultimately stressed words, only seven conform to Belikov’s rules. In five words, the reduplicant follows the xujVC^1−VC^1 pattern (m[a]ntážxujántáž ‘assembling-RED’ instead of montáž-xujáž, ljubví- xujubví ‘love.GEN.SG-RED’ instead of ljubví- xuebví) ; in three words, the pattern is xujC^0−VC^1 (lar’kí-xujkí ‘booth-RED’, xujkí coinciding with an existing derivative of xuj meaning ‘little pricks’).

Interestingly, the reduplication of ultimately stressed words seems to be avoided. The distribution of stress positions in reduplicated words is clearly different from the general distribution of stress in nouns. A control group of 100 nouns selected randomly from blog posts shows a substantially higher proportion of ultimately stressed words (see Table).

The avoidance of xuj-reduplicated forms in words with ultimate stress is best explained by a constraint on the length of the repeated part of the word: it should not be too short, which is typical of morphological doubling (Inkelas and Zoll 2005, Inkelas 2008). Otherwise it would violate
the MAX-BR constraint requiring base-reduplicant identity (McCarthy and Prince 1995; see also Alderete et al. 1999). In our talk, we will discuss the application of competing approaches to Russian xuj-reduplication.

<table>
<thead>
<tr>
<th>Stress</th>
<th>Examples of xuj-reduplication</th>
<th>Control group</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Number of words</td>
<td>Example</td>
</tr>
<tr>
<td>ultimate</td>
<td>31 (7.1%)</td>
<td>gúgl-xujúgl</td>
</tr>
<tr>
<td>penultimate</td>
<td>237 (54%)</td>
<td>kásting-xujásting</td>
</tr>
<tr>
<td>antepenultimate</td>
<td>166 (37.8%)</td>
<td>sánkcii-xujánkcii</td>
</tr>
<tr>
<td>preantepenultimate</td>
<td>5 (1.1%)</td>
<td>ménedžery-xuéndžery</td>
</tr>
</tbody>
</table>

Table: Stress positions in the examples with xuj-reduplication as compared with the control group

References


Yang Li

Complete and incomplete neutralisation in Fuzhou tone sandhi

Incomplete neutralisation (IN) refers to phonological alternations that produce perceptually (almost) identical outputs that nevertheless leave instrumentally detectable differences. IN has been widely reported in final devoicing processes in European languages [1]–[3]. Theoretically, IN is a challenge for classical modular feed-forward model of phonology [4], [5]: If the derivation of surface voiceless from underlying voiced obstruents is discrete, then phonologically neutralised objects should have identical acoustic outputs. IN would be a surprise.

One confounding factor in final devoicing IN is orthography [4], [6], e.g. German rad and rat suggesting underlying voicing distinction. This paper reports production and perception experiments on potential IN effects in Fuzhou Min tone sandhi, where results are largely free from orthographic (no tone marking in writing) and metalinguistic (low in Fuzhou) confound. Most neutralisations investigated to date are of the A / B \rightarrow B type, e.g. /d/ and /t/ neutralised into [t]. In Fuzhou tone sandhi a single surface tone may come from multiple underlying tones, none of which are identical to the surface tone. This is shown in Table 1: in a tone sandhi domain, the final syllable retains its citation tone, while all pre-final (target) syllables undergo sandhi. Sandhied tones are determined jointly by target tones and context tones. Two neutralisation groups will be the focus in this paper. They are listed in (1) and (2) and are in bold in Table 1.

(1) 44, 53 \rightarrow 44 / ___ 53
(2) 242, 44 \rightarrow 53 / ___32

20 native Fuzhou listeners were first asked to categorise apparently homophonous disyllabic words which minimally differ in the underlying tone of the first syllable, with the auditory stimuli created from multiple tokens and speakers. Mixed-effects logistic regression reveals that underlying tone is not significant in categorisation performance for both (1) and (2). 10 native speakers of Fuzhou then read disyllabic words embedded in an invariant carrier phrase [̃nuai̯31 puo̯44 t̃øy̯44 ___ k̃øy̯44 ny̯33 t̃i̯a̯n̯55], “I want to read _ for you to listen”. Within each neutralisation group in (1) and (2), test words crucially differ in the first underlying tone with segments held constant. Statistical analysis combines SS ANOVA [7] and Bayesian inference [8]. The former creates smoothed splines with surrounding ribbons representing the 95% confidence intervals. The latter produces Bayes Factors, which in contrast to previous approaches can both confirm and reject the IN hypothesis.

Figure 1 (right) shows that sandhied T44 and T53 overlap almost completely, a sign of complete neutralisation into surface T44. As for surface T53 (left), in both conditions sandhied tones start from the top and falls steeply, reflecting the citation acoustics of T53. While the ribbons overlap considerably, the initial section (0~20%) of the F0 from underlying T44 is significantly higher than that of underlying T232. The average difference is 0.68 semitones, or 6.75 Hz, above just-noticeable threshold but below that of typical tonal contrast. Bayesian inference corroborates the acoustic sameness for surface T44 and difference for surface T53.

The co-existence of both complete and incomplete neutralisation puts particular challenge on Tur-
bidity Theory’s [9] account of final devoicing, where voiced obstruents but not underlying voiceless ones are posited to have a monovalent [voice] feature. Highly ranked FINDEV constraint forces [voice] to be unparsed and its ambiguous phonetic interpretation results in IN [9, p. 1371], see also [10]. This argument is difficult to advance in the present case, as the tonal analogue to the supposed difference in segmental [t] and [d] is hard to come by and in any case contrary to the observation that the type of tone sandhi in Fuzhou involves whole-tone substitution rather than feature alteration [11], [12]. Further, theories along this line have to posit differences in phonological representations only for those tone sandhi groups which show IN effect, but not for sandhi groups which do not, reducing predictive power. The solution to IN favoured here is a hybrid model of phonological competence which encompasses both abstract categories and stored exemplars [13]–[15], with IN following from the co-activation of morphologically related forms [16].

<table>
<thead>
<tr>
<th>Context tone</th>
<th>44</th>
<th>53</th>
<th>32</th>
<th>212</th>
<th>232</th>
</tr>
</thead>
<tbody>
<tr>
<td>Target tone ↓</td>
<td>44</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>213</td>
<td></td>
<td></td>
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<tr>
<td>242</td>
<td>44</td>
<td></td>
<td></td>
<td>53</td>
<td></td>
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<tr>
<td>53</td>
<td></td>
<td>32</td>
<td>21</td>
<td></td>
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<tr>
<td>32</td>
<td>21</td>
<td>24</td>
<td>44</td>
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</tbody>
</table>

Table 1. Fuzhou tone sandhi.

Figure 1: Time normalised F0 contour of sandhi T53 from underlying T44 and T232 (left) and T44 from underlying T44 and T53 (right), in semitones, with 95% confidence interval shown as ribbon, from 10 speakers.

References


Tone sequences in lexical processing of Beijing Mandarin

An observation: In Mandarin, [ma] with a dipping tone (tone 3) can mean ‘horse’ 马, ‘number, code’ 码, ‘amethyst’玛, or ‘ant’ 蚂: for a listener, identifying a given syllable, even with tone, does not select a single word, but merely an array of homophones. In reality, most content words in Mandarin are disyllabic, where one syllable acts as a bound morpheme. With the addition of a second syllable, segmental content alone will often suffice to select a unique lexical item: the only lexicalized item corresponding to the segments [manao] is 玛瑙 ‘amethyst’ (tones 33), similarly [mayi] is 蚂蚁 ‘ant’ (tones 33) (Lin, 2016).

The problem: To what extent do tone representations contribute to Mandarin word processing, given that tone information is so often unnecessary to identify a word? Most previous studies use monosyllabic words (Lee, 2007, Sereno and Li, 2015), but monosyllables only represent a small part of the lexicon; furthermore, as said earlier, tone is uninformative there: even with tone, identification is usually not unique.

Our hypothesis: When there are segmental homophones, as in the two pairs below, tone is involved in lexical selection, and the word with the more-frequent tone sequence has an advantage. Below are two such pairs of items:

<table>
<thead>
<tr>
<th>segments</th>
<th>tones</th>
<th>tones</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1) [tʃyli]</td>
<td>42 距离 ‘distance’</td>
<td>34 举例 ‘to give an example’</td>
</tr>
<tr>
<td>(2) [huli]</td>
<td>43 护理 ‘to take care of’</td>
<td>25 狐狸 ‘fox’</td>
</tr>
</tbody>
</table>

The study: We presented native speakers of Mandarin with disyllabic sequences (audio) that were tonally ambiguous between two words, such as (1) and (2). The stimuli were manipulated so that the pitch contour was an average between the two possible tone sequences (Figure 1). Participants were primed with an unrelated disyllabic word that bore either the same tone sequence as one of the word candidates or an unrelated tone sequence. They were then asked to identify the tonally ambiguous token. We tested for effects of word frequency and tone sequence frequency (how likely it is to encounter a given sequence of two tones in the language).

Results: All else being equal, participants tended to choose the more-frequent word and the more-frequent tone sequence. We show that tone sequence frequency interferes with word frequency information during the processing of disyllables in Mandarin. When word frequency and tone frequency did not favour the same candidate, participants were less likely to pick the word with the same tones as the prime (Figure 2). Such inhibitory effects of tone priming have been observed previously (Poss, Hung and Will, 2008). Additionally, according to our preliminary results, “tone frequency” is better modeled as frequency in running speech (regardless of word boundaries) rather than frequency in words. This suggests that tone sequences and their frequency are represented at the disyllabic level, and these representations influences lexical selection when segmental information is ambiguous.
**Figure 1.** Pitch contours involved in creating the target stimulus for tɔyli: 42 ‘distance’ in blue, 34 ‘to give an example’ in magenta, and the resulting averaged contour in green. Durations were normalized. The green contour replaced the pitch contour on a nonce tɔyli 11 item, produced with level tones.

**Figure 2.** Rates of responding with the more-frequent word. Priming conditions are: prime matches tones on the more frequent word alternative (mf), prime bears tones unrelated to either word alternative (u), prime matches tones on the less frequent word alternative (lf). Frequency conditions are: the more frequent word alternative bears the more frequent tone sequence (FREQ_MATCH), the more frequent word alternative bears the less frequent tone sequence (FREQ_MISMATCH). Error bars are standard error to the mean.
References
Wordhood at all levels: A stratal account of minimality effects in Kharia

The prosodic word domain (ω) in Kharia (Munda) comprises the lexical root as well as stem and word level affixes. Clitics, however, are not included in ω (Peterson 2008, 2011):

(8)  
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<tbody>
<tr>
<td>a</td>
<td>[laN]ω</td>
<td>‘tongue, language’</td>
<td>c</td>
</tr>
<tr>
<td>b</td>
<td>[buwaN]ω</td>
<td>‘snake’</td>
<td>d</td>
</tr>
</tbody>
</table>

While (1) shows that ω in Kharia can in principle stretch over any number of σ, there are two morphological contexts in which Kharia imposes a strong bi-syllabic minimality restriction: (i) The masdar is identical to the verb stem unless it is monosyllabic, in which case the masdar is formed by full stem reduplication ((2) ab.); (ii) A clitic must be included in ω if ω were otherwise monosyllabic ((2) cd.). We thus face the (seemingly) paradox situation that Kharia exerts strong minimality restrictions in two specific morphological contexts, while being generally non-restrictive elsewhere.

(9)  
<p>| | | | |</p>
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</thead>
<tbody>
<tr>
<td>a</td>
<td>[kersoN]ω</td>
<td>‘marry (MASD)’</td>
<td>c</td>
</tr>
<tr>
<td>b</td>
<td>[lam-lam]ω</td>
<td>‘RED-seek (MASD)’</td>
<td>d</td>
</tr>
</tbody>
</table>

I propose an analysis that is couched in Stratal OT (Bermúdez-Otero, 2012) coupled with Colored Containment (Trommer, 2015) and relies on the Prosodic Hierarchy and the idea of Prosodically Defective Morpheme affixation (Zimmermann, 2014). My account distinguishes three morphological strata with different constraint rankings. On the stem level, a constraint (CAUS) demanding a prosodic word node to dominate no less than two σ (word minimality) is ranked high, but is satisfied vacuously, since no ω nodes are present in the lexical morpheme representations in Kharia. The only exception is the masdar, which in my analysis is formed at the stem level by affixing an empty prosodic word node: MASD  ω. The effect of this is stem reduplication in the case of monosyllabic stems. On the word level, a high-ranked (CAUS) demands structures to be headed by a ω, but the minimality constraint is ranked very low, leaving words as in ((1) a.) unaffected. Word level insertion of epenthetic ω thus counter-feeds stem level reduplication. The input to the postlexical level is the output of the word level plus any number of clitics. ω  σ is ranked high on this level, and for that reason, the ω domain extends to a clitic if the word is monosyllabic. Contrary to the stem level, however, no repair mechanisms such as reduplication are allowed to satisfy ω  σ, which means the relevant faithfulness constraints outrank ω  σ.

Additional evidence for this analysis comes from two angles. First, masdar forms of verbs prefixed with a causative morpheme never trigger reduplication, even if the verb root is monosyllabic ((3) ab.). This follows naturally from the aforesaid if CAUS is also analysed as a stem-level affix (see table (5)). Second, ω expansion is blocked if the word ends with a glottal stop ((3) cd.). The reasons for this are a bit more intricate. Kharia has a word level ban on coda [ʔ], which is repaired by echo vowel epenthesis (often omitted in transcriptions, but clearly present phonetically). The
input to the postlexical level is therefore not monosyllabic, but bisyllabic, and there is no reason for \( \omega \) to extend to a clitic (see also (4)).

\[(10)\]  
\[
\begin{align*}
\text{a} & \quad [\text{ob-ru}\?]\omega \text{‘OBL-open (MASD)’} & \quad \text{c} & \quad [\sigma?]\omega = \text{ki ‘house=PL’} \\
\text{b} & \quad [\text{ð’b-bay}]\omega \text{ ‘CAUS-make (MASD)’} & \quad \text{d} & \quad [\sigma?]\omega = \text{te ‘house=OBL’}
\end{align*}
\]

This approach to minimality effects captures important generalisations about Kharia phonology without resorting to lexically indexed constraints (Pater, 2009) or construction-specific cophonologies (Inkelas and Zoll, 2005). By adopting a stratal perspective, the seemingly exceptional behaviour of masdar forms and clitics can be deduced to a variably-ranked constraint \( \omega \Rightarrow \sigma \) demanding prosodic minimality on the stem level and the post-lexical level, but not on the word level.

\[(11)\]  
Evidence for \( \omega \):  
The primary phonetic manifestation of \( \omega \) is a rising pitch pattern (LH) over the whole word domain. Peterson (2011, 35–49) provides acoustic evidence that pitch consistently stops rising at the right \( \omega \) edge, with F0 falling considerably low on any clitics outside of \( \omega \). Acoustic illustrations of echo vowel epenthesis are given as well.

\[(12)\] Stem-level: Masdar of causatives

<table>
<thead>
<tr>
<th>Input = a.</th>
<th>( \omega )</th>
<th>( \sigma )</th>
<th>( \phi )</th>
<th>DEP</th>
<th>( \omega! )</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \omega )</td>
<td>( \phi )</td>
<td>( \omega )</td>
<td>( \phi )</td>
<td>( \omega )</td>
<td>( \sigma )</td>
</tr>
<tr>
<td>a.</td>
<td>( \mu \mu )</td>
<td>( \mu \mu )</td>
<td>( \mu \mu )</td>
<td>( \mu \mu )</td>
<td></td>
</tr>
<tr>
<td>o b r u ?</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td></td>
</tr>
<tr>
<td>b.</td>
<td>( \omega )</td>
<td>( \phi )</td>
<td>( \sigma )</td>
<td>( \sigma )</td>
<td>( \sigma )</td>
</tr>
<tr>
<td>o b r u ?</td>
<td>*</td>
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<td>**</td>
</tr>
</tbody>
</table>
References
An Optimality Theory analysis of Hungarian echo words

Echo-word formation in Hungarian has many patterns. This presentation attempts to identify the morphophonological properties and the different types of echo words through analysis of a smaller corpus, a manually filtered version of Szikszainé’s (1993) child language and dialect corpus supplemented with the results of a web search. The analysis provides an explanation for the multiple forms and the observed variation by comparing echo word formation to diminutive derivation (Rebrus & Szigetvári 2015) and morphological schemas (Bybee 2001, Sóskuthy 2012).

The analysis identifies three main patterns: consonant variation (csiga-biga ‘snail-DIM’, cica-mica ‘cat-DIM’), vowel variation (fidres-fodros ‘frilly-DIM’, girbe-gurba ‘crooked-DIM’), and consonant and vowel variation (izeg-mozog ‘move-DIM’, zene-bona ‘music-DIM’). Labiality plays an important role in all these patterns: 94 per cent of the onsets in the second root contain at least one labial segment (for the sake of the analysis, rounded vowels, labial consonants and labiodental consonants are treated as labials).

The formal analysis of echo-words is done in Optimality Theory which is compatible with the concept of output-oriented schemas, as this theory is capable of capturing relationships between surface forms as well as input-output correspondences. The three patterns will be modeled in OT as having their own constraint rankings, as co-phonologies in the language (Inkelas & Zoll 2003). The most important constraint (DIFF) requires that the output must not contain two identical elements (extending the Obligatory Contour Principle to morphophonological elements (Yip 1998)), which means that the two roots in an echo word have to be different. After the DIFF constraint rules out totally reduplicated candidates (*csiga-csiga), four IDENT constraints define the difference between the first and second root. The IDENT constraints are taken from McCarthy & Prince’s (1995) Correspondence Theory, stating that correspondent segments are identical in a certain feature. In the case of V-variation, the ranking IDENT-IO(C) » IDENT-IO(V) will choose the optimal form girbe-gurba instead of *girbe-mirbe. The remaining two IDENT constraints require the identity of the value of the [labial] feature: in echo words containing C-variation, the ranking IDENT-IO[-lab] » IDENT-IO[+lab] chooses cica-mica as the correct output instead of *cica-kica. The exact place of the labial segment is given by ALIGN constraints (McCarthy & Prince 1993, Buckley 2009). The ALIGN constraint determines the place of the labial segment in the onset of the root, and the *ALIGN constraint ensures that the labial segment is the farthest away from the left edge of the word.

According to the first hypothesis, the three patterns will create three different constraint rankings. The second hypothesis states that the ranking of the CV-variation will be the result of merging the rankings of C- and V-variation.

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Asymmetric variation

A form may be subject to phonological variation in more than one phonologically unrelated “dimension”. In this paper we analyse a phenomenon in which the presence/absence of variation in one such dimension nevertheless depends on the presence/absence of variation in another. This is theoretically interesting because (i) it is an “unnatural” type of interaction (cf Hayes et al 2009) that refers not to phonological properties whose interaction is unnatural, but to the interdependence of the occurrence of variation in unrelated dimensions; and (ii) it is problematic for an analysis that derives variation from a single underlying form by optional rules or variably ranked or unranked constraints (Anttila 2007). We propose an analysis that views this interaction as a Paradigm Cell Filling Problem (Ackermann et al 2009), by identifying paradigmatic patterns which licence inferences about the surface properties of the content of the cells of a paradigm and we show that that the unusual interdependence results from an interplay of paradigmatic requirements (prescribing uniformity, markedness, and paradigm class membership).

The Hungarian 3sg possessive morpheme (POSS) is represented by four allomorphs: -ja, -je, -a, -e, which are selected by two parameters: vowel harmony and yodfulness. Stems may be variable and some are variable in both respects, cf (1). Crucially, the latter lack the yodless -a allomorph, ie no stem can take all four allomorphs, cf (1f).

Suffix-initial vowels may be low or mid in nominal paradigms. Low linking vowels facilitate yodless POSS forms, (2b) and (2c), because the choice of yodless -a, -e enhances Paradigm Uniformity (PU). No such preference for yodless POSS forms constrains the choice in paradigms with mid back linking vowels since neither the yodless nor the yodful POSS alternant ( -a, -ja ) is better for PU, (2a). Only back stems show this difference between mid vs low linking vowel paradigms (“non-lowering” vs “lowering” stems); front stems always have a low -e.

Vowel harmony applies variably after “mixed” Bɛ stems, (1d–f), and harmonic behaviour is generally consistent across suffixes within a paradigm (Harmonic Consistency, HC). Despite HC, roots like fote ‘armchair’, (1f), which are variable with respect to both harmony and the suffix-initial yod, lack the yodless back harmonic 3sg poss suffix -a. That is, variability is suspended in one dimension when it manifests itself in the other dimension. We claim that this due to (i) the way PU applies in lowering vs non-lowering stems and (ii) the fact that all Bɛ stems are non-lowering.
### Tables

(1) Variation in 3sg possessive forms

<table>
<thead>
<tr>
<th>stems</th>
<th>forms (number of grammatical forms)</th>
<th>harmony</th>
<th>yod</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. motor ‘engine’</td>
<td>motorja, *motorje, *motora, *motorë (1)</td>
<td>only back</td>
<td>only j</td>
</tr>
<tr>
<td>b. va;las ‘answer’</td>
<td>*va;lasja, *va;lasje, va;lasa, *valase (1)</td>
<td>only back</td>
<td>only no j</td>
</tr>
<tr>
<td>c. vira:g ‘flower’</td>
<td>vira:gjo, *vira:gje, vira:go, *vira:ge (2)</td>
<td>only back</td>
<td>variable</td>
</tr>
<tr>
<td>d. potent ‘snap fastener’</td>
<td>patenteja, patenteje, *patenta, *patente (2)</td>
<td>variable</td>
<td>only j</td>
</tr>
<tr>
<td>e. notes ‘notebook’</td>
<td>*notesja, *notesje, notesa, notesë (2)</td>
<td>variable</td>
<td>only no j</td>
</tr>
<tr>
<td>f. fotel ‘armchair’</td>
<td>fotelja, fotelje, *fotel, fotelë (3)</td>
<td>variable</td>
<td>variable</td>
</tr>
</tbody>
</table>

(2) Prototypical nominal paradigm classes by the quality of the suffix-initial vowel

<table>
<thead>
<tr>
<th>backness &amp; height of the suffix-initial vowel</th>
<th>a. back &amp; mid</th>
<th>b. back &amp; low</th>
<th>c. front &amp; low</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-possessive</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Plural</td>
<td>kar-åk</td>
<td>fal-åk</td>
<td>per-åk</td>
</tr>
<tr>
<td>Adjz</td>
<td>kar-åf</td>
<td>fal-åf</td>
<td>per-åf</td>
</tr>
<tr>
<td>Verbz</td>
<td>kar-ål</td>
<td>fal-åz</td>
<td>per-ål</td>
</tr>
<tr>
<td>Possessive</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1sg</td>
<td>kar-åm</td>
<td>fal-åm</td>
<td>per-åm</td>
</tr>
<tr>
<td>2sg</td>
<td>kar-åd</td>
<td>fal-åd</td>
<td>per-åd</td>
</tr>
<tr>
<td>3sg</td>
<td>kar-ål / kar-å</td>
<td>fal-åa</td>
<td>per-å</td>
</tr>
<tr>
<td>uniformity with 3sg</td>
<td>no / no</td>
<td>yes</td>
<td>yes</td>
</tr>
<tr>
<td>‘arm, faculty’</td>
<td>‘wall’</td>
<td>‘trial’</td>
<td></td>
</tr>
</tbody>
</table>

### References


Gemination in Tashlhiyt whistled speech

Whistled speech is an ancient natural practice that consists in a phonetic transformation and emulation of the spoken signal into a simple melodic line made up of frequency and amplitude modulations of a whistled signal. This paper addresses this special traditional practice in Tashlhiyt, an Amazigh language spoken in Morocco. It questions more specifically how the key properties of Tashlhiyt lexical gemination in different prosodic positions are carried into a whistled signal.

Fieldwork was organized during November 2015 in the High Atlas. Audio materials were collected at this occasion with three different traditional whistlers. A corpus was built from a list of selected isolated words that were recorded in a situation of elicitation. The corpus was composed of four minimal or near-minimal pairs contrasting singleton /t d k g/ to their geminate counterparts /tt dd kk gg/ in three different word positions: initial, intervocalic and final. Three traditional whistlers, whom we identify OT (34 years old), MO (33) and SA (35), were asked to speak and whistle three times each word. The whistled material was segmented based on visual inspection of the acoustic signals and spectrograms. Temporal and non-temporal measurements were taken from the signal. The temporal parameters include duration of pre-consonantal vowels in intervocalic and final positions, duration of stop closure, and duration of post-consonantal vowels in initial and intervocalic positions. Nontemporal parameters include the frequency value at consonant-vowel transitions for word-initial and word-intervocalic position and the frequency value at vowel-consonant transition for word-final position. An example of a Tashlhiyt whistled word is given in Figure 1.

Results show that the clearest cue to gemination in intervocalic position is closure duration. As shown in figure 2, the duration of the silent period corresponding to whistled stops is longer for geminates compared to singletons, the duration of the silent period corresponding to whistled stops is systematically longer for geminates compared to singletons. These duration differences are significant at the p<.00001 level. Pre-consonant vowel duration is also affected by gemination, as shown in figure 3: vowels preceding geminates are significantly shorter (p<.01). Gemination, on the other hand, has no significant effect on post-consonant vowel duration (p>.01). Looking at non-temporal parameters, our findings show that frequency values at the onset of consonant-vowel transitions is also affected by gemination: geminates displaying higher values compared to singletons (see figure 4).

The transposition of consonants in whistling involves mainly consonant-vowel transitions. This makes it impossible to measure consonant duration in word-initial position. Gemination in this position is primarily marked by significant differences in frequency values at the onset of consonant-vowel transitions, with significantly higher values for geminates compared to singletons (SA: 2113>1696 Hz, MO: 2661>2299 Hz, OT: 2469>2145 Hz). Gemination contrast in word-final position is also primarily marked by consonant duration, geminates being produced with longer stop closures (253 ms, SD = 56) compared to singletons (158 ms, SD = 38). This parameter was measured only for forms produced with a whistled stop release (65 tokens out of 72). The
other parameters did not so accurately distinguished singletons from geminates compared to word-initial and word-intervocalic positions. Indeed, only subject OT distinguished singletons and geminates in terms of duration of preconsonantal vowel duration (167 ms for singletons vs 148 ms for geminates) and frequency values at vowel-consonant transitions (2434 Hz for singletons vs 2738 Hz for geminates).

Because of constraints inherent to the whistled production, whistled speech simplifies the phonetics of spoken speech but is still based on the phonological patterning of spoken languages (Cowan 1958, Rialland 2005, Meyer 2015). Compared to spoken forms, our results show that whistling transposes the basic strategies used in normal speech to convey lexical gemination contrast. As for normal speech, duration is used as the primary correlate to implement the singleton/geminate contrast in whistled Tashlhiyt, suggesting that the contrast is temporal in nature. This clearly supports a two X-slot representation reflected by the observed differences in consonant closure duration. Supplementary enhancing cues are also conveyed. Preceding vowel shortening and higher frequency values for whistled geminates may be interpreted as secondary cues which serve to enhance the primary correlate by contributing additional acoustic properties which increase the perceptual distance between singletons and geminates. These enhancing cues may take on distinctive function in cases where the primary correlate – duration – is not perceptually recoverable. This is, for instance, the case of higher frequency values in word-initial position where duration differences cannot be acoustically implemented.
References
Lexical storage vs. phonological computation: a case study of stress variation in English -(at)ory derivatives

This paper presents a formal analysis based on the results of a production experiment on English -(at)ory derivatives. The participants, 31 native speakers of British English, were asked to read 25 sentences with -(at)ory derivatives extracted from an oral corpus. The sentences of a parallel experiment served as fillers. The experiment shows a higher degree of stress variation than previously acknowledged, both across and within speakers. (e.g. compénsatory~cómensatory~compensátry, while the OED only registers the first form). The proposal is that the variation can be explained by taking into account the interaction of morphological and prosodic structure, phonological computation, faithfulness to a verbal base, and storage of prosodically specified forms.

The analysis divides the participants in the experiment into two major groups depending on the default suffix they produce, -ARY or -ATORY. The -ORY type is further subdivided into those speakers pronouncing a full low vowel in -ory and those exhibiting (several degrees of) vowel reduction. Figure (1) shows how the default morphemes are mapped into different prosodic representations (modeled after previous proposals to formalize the recursion of prosodic structure made by Itô and Mester (2009) and Bermúdez-Otero (forth)). The main idea is that syllables and feet can be underlyingly specified as adjoined to another feet. By placing a constraint requiring faithfulness to this type of adjunction (IDENT-σ → Σ°) above the alignment constraints, we obtain the different outcomes observed in the experiment (see Figure (2)).

Figure (3), on the other hand, explains why no speaker is completely consistent in showing a unified stress pattern as predicted by a particular underlying suffix. High ranking faithfulness to a specified prosodic head may cause primary stress to move a syllable leftward with respect to the unmarked pattern in order to comply to the prosodic configuration of a local base (i.e. an immediate subcomponent of the derivative). For those speakers with the default -ATORY suffix, a derivation from a verb ending in -ate would undergo either a process of haplology or morphological selection, and primary stress would be preserved as secondary stress.

Next, intra-speaker variation is accounted for by the possibility for complex words, not only independent morphemes, to be stored in the mental lexicon with their prosodic specification (see e.g. Jackendoff 2002). E.g., figure (4) shows that, among speakers with default -ORY, there are two possible stress patterns for a word such as oscillatory. The reason for this is to be found in the date the word entered the English lexicon. Oscillatory is documented more than half a century earlier than the verb oscillate, so it was probably first stored with the default oscillatory pattern, as illustrated by the derivation in (2). Once the -ate verb form entered the lexicon and was able to influence the -ory derivative, the alternant óscillatory could then be generated (see Figure 3). As a result, current speakers may either use the stored derivative or generate a new stress-preserving one, giving the impression of a nonsystematic variety of forms (cf. the absence
of variation in Litigatory).

By allowing only for local bases to influence the structure of the derivative and also limiting the access of morphosyntactic information to the phonology to indirect reference to prosodic structure, the analysis offers a more restrictive approach to the data than previous accounts of stress variation in English complex words (e.g. Stanton and Steriade 2014, Zamma 2014). This in turn has the advantage of yielding a higher degree of empirical content: “the more a statement forbids, the more it says about the world of experience” (Popper 2002:103). In addition, the proposal opens the way towards a diachronic analysis in which a highly specified morpheme becomes less idiosyncratic by progressively losing parts of its prosodic specification. Thus, the suffix that has completely lost all underlying specification renders derivatives that comply to the less marked stress pattern in the language; i.e. the pattern exhibited by the majority of monomorphemic words (cf. Figures (1a) to (1c)).

(1) **Underlying representations**

(a) \[ \Sigma' \quad \Sigma \]

(b) \[ \Sigma' \quad \Sigma \]

(c) \[ \Sigma' \quad \Sigma \]

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(2) **Phonological computation: preservation of prosodic structure from the suffix**

<table>
<thead>
<tr>
<th>OscillateSuffix</th>
<th>IDENT-(\sigma\Sigma)</th>
<th>NON-FINALITY</th>
<th>ALIGN-HEADFT-R</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oscill-ory</td>
<td>*!</td>
<td></td>
<td>*</td>
</tr>
<tr>
<td>Oscill-atory</td>
<td>*!</td>
<td></td>
<td>*</td>
</tr>
</tbody>
</table>

| Oscill-átoriy   | *!                    |              | *              |
| Oscill-atory    | *!                    |              | *              |

101
(3) **Phonological computation:** preservation of prosodic structure from the local base

<table>
<thead>
<tr>
<th>(ó.sci)llâte-ry</th>
<th>MAX-FTHEAD</th>
<th>ALIGN-HEADFT-R</th>
</tr>
</thead>
<tbody>
<tr>
<td>⇒ (ó.sci)llâa(ò.ró)</td>
<td>*</td>
<td>**</td>
</tr>
<tr>
<td>o(sci.lîa)(ò.ró)</td>
<td>!</td>
<td>**</td>
</tr>
</tbody>
</table>

(4) **Lexical storage** (dates of first attestation from OED)

1660: *oscillatory* enters the lexicon → 1726: *oscillate* enters the lexicon

oscillat-ory → o(sci.lîa)(ò.ró)

variation

(ó.sci)llâte-ory → (ó.sci)llâa(ò.ró)

1606: *litigate* enters the lexicon → 2016 (not in OED): *litigatory* enters the lexicon

(lî.tî)gâte-ory → (lî.tî)gâte(ò.ró)

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Coronal underspecification as a possible result of transmission noise

Coronals seem to be special: they are cross-linguistically more frequent (Maddieson 1984), are acquired earlier (Stemberger & Stoel-Gammon 1991), convey less information (Hume, Hall & Wedel 2016), and assimilate more frequently than labials or dorsals (Boersma 1998). This special status led several phonologists to propose that coronals are featurally underspecified (e.g., Lahiri & Reetz 2002; Dresher 2009). We present evidence from a learning experiment supporting the underspecification of coronals, and a neural network simulating the experimental results. In this neural network, we incorporated transmission noise.

We conducted a learning experiment with German listeners. Participants (n = 12) were exposed to a set of syllables, either /pa/, /ta/ and /ka/, or /ba/, /da/ and /ga/; these syllables were presented in isolation, and all of them occurred 24 times in random order. Participants were asked to estimate how often they had heard the sounds. The frequencies of /ta/ and /da/ were systematically underestimated: the coronals received statistically significantly lower estimates than the other places of articulation (coronal vs. labial: p = .009; coronal vs. velar: p = .007; labial vs. velar: p = .835). We interpret this underestimation as evidence for the underspecification of coronals: the repeated activation of the [labial] and [dorsal] feature values may lead to higher frequency estimates, and because no feature specification exists for the coronals, their estimate falls short.

We then created a neural network simulating the acquisition of the feature combinations that appeared in the experiment. The network learns combinations of a place feature ([labial], [coronal], [dorsal]) and a voicing feature ([–voice], [+voice]), where both features correspond with phonetic continua. Additionally, we implemented the observation that in real-life learning, language transfer between the teacher and the learner is imperfect because transmission noise may scatter input tokens in the phonetic space (Ohala 1981): it may, for instance, cause an intended labial sound to be perceived as mostly labial and also slightly coronal. Now, coronal place has an advantage over the other two places of articulation: the transmission noise scatters some tokens from both adjacent categories into coronal place, while only intended coronal tokens are scattered into the adjacent places (see Fig. 1). In our network, this entails that adjacent groups of place nodes may be activated simultaneously. We ran 2,000 neural networks, each of which learnt 10,000 input tokens, with identical probabilities of occurrence for intended labials, coronals and dorsals. Due to the noise-induced scattering, the resulting cumulative activation of the coronal nodes was significantly higher than that of the labial and dorsal nodes (both p < .001). There was no such difference between the labials and dorsals (p = .209). Additionally, this higher activation leads to a higher output frequency for the coronals than for labials or dorsals (both p < .001, lab. vs. dor. p = .923), even if all places of articulation have equal input probabilities.

We propose that the occurrence of transmission noise plays a role in underspecification at the phonological level, for two reasons. (1) A relation may emerge between intended coronals and any place feature value, and the coronal place nodes may be activated for any intended category, so there are more mismatches between intended and perceived categories in the coronals; (2)
as a result of the transmission noise, coronals are more frequent than labials and dorsals.

\[
\begin{array}{c}
\text{parent} & [\text{labial}] & [\text{coronal}] & [\text{dorsal}] \\
\text{child} & [\text{labial}] & [\text{coronal}] & [\text{dorsal}]
\end{array}
\]

**Fig. 1.** Schematic representation of the relations between intended and perceived categories: there are more mismatches for coronals (namely 3) than for labials (2) or dorsals (2).

**References**


From accent to stress: the verb prosody of Serbo-Croatian creolised standard varieties

The goal of this paper is mapping out the verb prosody of the varieties of Serbo-Croatian (henceforth, S-C), which have undergone a switch from a pitch-accent system to a stress system and consider these data in the context of prosodic theory. Many if not all stress varieties have developed an innovative system, in which verbs have no lexical prosody, but surface with a morphologically conditioned stress pattern. This constellation, which has independently emerged in a number of ‘peripheral’ varieties of standard S-C, may very well be unique within Slavic. We argue that two typologically unmarked properties of stress systems emerge when a pitch-accent system collapses into a stress system, viz. (a) stem-based stress and (b) morphologically conditioned verb stress (e.g. Alderete 2001).

Standard S-C is a pitch-accent system based on the central, Neo-Štokavian dialects, in which the distribution of tone guides the distribution of stress (for a recent overview, see Werle 2009). High tone is associated either to one or to two syllables in a word and stress is always on the leftmost syllable endowed with a high tone. The former prosodic pattern (two adjacent syllables with a high tone, stress on the first of them) is usually referred to as rising accent, whereas the latter pattern (stress and tone co-occur on one syllable) is referred to as falling accent. Falling accents can only occur word-initially. In (1) some examples of nouns with rising (a) and falling (b) accents are provided. Capitalisation is used to represent the presence of a high tone, double vowels represent vowel length.

All accounts of S-C prosody agree that the prosody (i.e. tone and vowel length) is lexically encoded, so that stems like *tema* contrast underlingly with stems like *škola* and stems like *muzika* contrast underlingly with stems like *kapara* or *terasa*.

In a considerable part of the S-C language area the local dialect had a rather different prosodic system and, as a consequence of the standardisation process, in these areas the standard prosody has undergone significant simplifications. In quite a few regional centres a stress system without tone and vowel length has emerged. Importantly, this happened both in those areas where a stress system without vowel length had existed in the local dialect (e.g. in Niš), but also in those areas where all local dialects have a pitch-accent system (e.g. in Bor, Zagreb and Rijeka), in both cases with very similar results. We term such stress varieties spoken in urban areas “creolised standard varieties” (henceforth CSV’s). In the nouns in (1), the new stress pattern can be derived relatively straight-forwardly from the standard system, by removing all the tone and length information from the phonological representation.

As can be read off the examples in (2), the words which we have seen in (1) now display much less contrast than in the classical standard system. The disyllables actually allow only one possible pattern, whereas for trisyllables some lexical encoding is still required, but there is only a two-way contrast (antepondultimate vs. penultimate). The nominal system of CSV’s therefore has
purely stem-based prosody, unlike that of the classical standard S-C. The simplification pattern is
even more prominent in verbs, where, as illustrated for in the present tense in (3), stress always
falls on the syllable before the tense ending. As the three examples of present tense verb forms
in (3) show, the location of stress in the classical standard language is no longer the predictor of
stress in CSV. The pattern in CSV is overall similar to that attested in Non-Neoštokavian dialects
(illustrated in 3c by a simplified representation, disregarding tonal information and vowel length),
with one crucial difference: the type with stress on the present-tense ending (stoj-i) is missing.
Another class in which the standard stress pattern won in CSV's is illustrated in the verb forms
in (5), prefixed versions of those in (4). In order to appreciate these examples, the infinitive form
(e.g. úb-iti) needs to be taken into account, as its ending also needs to remain unstressed. For
the verbs in (4) there is no avoiding stressed endings (because the stem b- contains no stressable
elements) and the substrate dialect pattern is probably preferred because it keeps the paradigm
uniform. However, in the verbs in (5) the substrate dialect 'unnecessarily' keeps the stress on the
ending, so that CSV goes with the standard in the present tense form and introduces a relative
prosodic innovation in the negated present tense form. In sum, the emergent CSV system has
a morphologically conditioned verb stress, which is the second unmarked property of stress sys-
tems we observe.

(1a) Rising accent tEEmA mUzlka terAsA
‘theme’ ‘music’ ‘terrace’
(1b) Falling accent škOOla kApara
‘school’ ‘down’ ‘payment’
(2) témA múzika terása
škóla kápara
(3a) Classical standard stOj-II tOvAr-ii UrAA-d-ii
(3b) Creolised standard varieties stój-i továr-i urád-i
(3c) Non-Neoštokavian dialects (stress only) stoj-i továr-i urád-i
‘s/he stands’ ‘s/he loads’ ‘s/he does’
(4a) Classical standard b-Iti b-Ijee nE b-Ijee
(4b) Creolised standard varieties b-íti b-íje ne b-íje
(4c) Non-Neoštokavian dialects b-íti b-íje ne b-íje
‘to beat’ ‘s/he beats’ ‘s/he does not beat’
(5a) Classical standard Ub-Iti Ub-ijee nE ub-ijee
(5b) Creolised standard varieties úb-iti úb-ije ne úb-ije
(5c) Non-Neoštokavian dialects ub-íti ub-íje ne ub-íje
‘to kill’ ‘s/he kills’ ‘s/he does not kill’

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Dominik Thiele & Caroline Féry

The allophonic fricative \[ \text{ç} \] in the Frankfurt dialect

The allophonic between the German velar and palatal fricatives, as in Buch [bu:x] ‘book’ and Bücher [by:çe] ‘books’ is well-known and is widely used as an example of complementary distribution in phonology textbooks. However, this allophony is not the only one that is found in the medial fricatives in German, thus \[ J, ç \] and \[ Ç \], excluding the peripheral [s] and [x]. In his seminal dissertation, Herrgen (1986) has attracted phonologists’ attention to the existence of the ‘medial’ fricative \[ ç \]. In the Frankfurt dialect that we have investigated, \[ ç \] only exists as a variant from the Standard German and not as a dialectal variant. It is thus only used as a ‘hypercorrection’. The Standard German allophony between \[ ç \] and \[ x \] is replaced by another allophony that we will illustrate and formalize in our talk. We will show the results of a production experiment, and illustrate the phonetic properties of the allophones. We used a reading task in which participants produced words containing \[ J, ç \] and \[ x \] in Standard German. Results are summarized as follows: 1) The back dorsal fricative \[ x \] has the same distribution as in Standard German, and is regularly realized after a back vowel if it is an underlying dorsal fricative. 2) Word initially, in Chemie and China, the allophone \[ J \] is always used. 3) The dialectal allophony of interest takes place between \[ S \] and \[ ç \]:

- \[ S \] and \[ ç \] are neutralized to \[ Ç \] when the preceding vowel is a front unrounded one \[ i, i, e, e, o, o, œ, œ, u, u, o, o \], see the data in (1).
- \[ J \] and \[ ç \] are neutralized to \[ J \] when the preceding vowel is rounded or low \[ y, y, ø, œ, u, u, o, o, o, a, a, a \], see (2).

In short, the Frankfurt dialect has a complementary distribution of \[ J \] and \[ ç \]. We assume an active phonological process, playing a major role in the distribution and emergence of this allophone. \[ J \] and \[ ç \] are both postalveolar, but they differ in rounding: \[ J \] is \[ +\text{-round} \] and \[ ç \] is \[ -\text{-round} \]. A round vowel triggers assimilation in rounding of the following medial fricative. The fact that \[ ç \] is the unrounded variant of the allophony, and not \[ ç \], is accounted for, in the following way. First in an OT approach, we use Flemmings’s (2001) Minimal Distance constraint to explain that only one of \[ ç \] and \[ ç \] can survive. Second \[ ç \] is chosen, because it is the corresponding unrounded version of \[ J \], rendering it a more natural allophone for \[ J \] than \[ ç \], which is articulated further back. Contrary to Robinson (2001) und Hall (2014) thus, we do not think that \[ ç \] is just the result of an articulatory simplification ([s] is the most unmarked coronal segment).

As for the phonetic properties, the rule of articulatory depth (see Machelett 1996) predicts that the further back a fricative is articulated, the lower its resonant frequencies are. The uvular \[ x \] has thus the lowest resonant frequencies, followed by the velar \[ x \]. Postalveolar \[ J \] has the next lowest resonant frequencies (2500 Hz – 7000 Hz). While the palatal dorsal fricative \[ ç \] is realized further back than the postalveolar \[ J \], its resonant frequencies start higher (3000 Hz). This does not contradict the rule of articulatory depth, because the rounding of the fricative \[ J \] lengthens the front cavity and therefore contributes to its lower resonant frequencies. Among the medial fricatives, the postalveolar \[ ç \] should have the highest resonant frequencies as it is realized at the
same place of articulation as [ʃ] and it is [unrounded] resulting in a shorter length of the oral cavity. We find supporting evidence in the Frankfurt dialect, see Figures 1 and 2. In Figure 2, it can be seen that word initial [ʃ] has lower resonant frequencies than final [œ]. As for measures, we chose duration, intensity, centre of gravity and standard deviation. Centre of gravity gives the average of frequencies in a spectrum. Standard deviation is a measure for how much the frequencies can deviate from the centre of gravity. Table (1) displays the results for one participant, for a total of 54 items (32 [œ]/ 22 [ʃ]): [ʃ] averages higher duration and intensity (mean/max), but has lower centre of gravity and standard deviation compared to [œ].

(1) Neutralisation of [ʃ] and [œ] to [œ] in Frankfurt dialect
   a. Standard dialect [ʃ]: Fisch, panisch, stoisch, englisch, französisch, Fleisch, Kirche
   b. Standard dialect [œ]: ich, Blech, echt, nicht, sich, wirklich, eigentlich, Kirche

(2) Neutralisation of [ʃ] and [œ] to [ʃ] in Frankfurt dialect
   a. Standard dialect [ʃ]: duschen, rasch, Löscher, keuschc, Bosch, hübsch
   b. Standard dialect [œ]: Bücher, Mulch, Mönch, Löcher

<table>
<thead>
<tr>
<th></th>
<th>Duration (ms)</th>
<th>Intensity-mean (dB)</th>
<th>Intensity-max (db)</th>
<th>Centre of Gravity (Hz)</th>
<th>Standard deviation (Hz)</th>
</tr>
</thead>
<tbody>
<tr>
<td>[œ]</td>
<td>69,7</td>
<td>47,6</td>
<td>49,2</td>
<td>3210,5</td>
<td>1037,1</td>
</tr>
<tr>
<td>[ʃ]</td>
<td>74,5</td>
<td>53,15</td>
<td>55,77</td>
<td>2922,6</td>
<td>590,85</td>
</tr>
</tbody>
</table>

Table 1. Average measures of [ʃ] and [œ] (for one participant)

Figure 1. [œ] in Standard dialect: *dich 'you.ACC' (0 – 9000Hz)*

Figure 2. [ʃ] and [œ] in Frankfurt dialect: *Strich ‘line/hyphen’ (0 – 15000Hz)*
References
Hall, Tracy Alan (2014): Alveolopalatalization in Central German as markedness reduction. Transactions of the Philological Society 112: S. 143-166.
Vowel and consonant harmony in Tagbana nominal classes

Vowel and consonant harmonies of the nominal domain of Tagbana, a Gur language of the Senufu family spoken in Côte d'Ivoire, are the topic of this talk (see Clamens 1957, Miehe 2012, and Traoré forthcoming, for Tagbana grammar). Morphology and phonology cannot be dissociated in these processes. Tagbana has four nominal classes primarily classified on the basis of their class markers (CM), class pronouns, presentatives, as well as other nominal morphemes, that have different forms in the singular and plural, all agreeing with their corresponding CM. The dependent and independent nominal morphemes underlie vocalic and consonantal harmony. The domain of the phonological phenomena investigated is the extended nominal phrase. In some cases, as in (1), the domain of agreement extends to the entire sentence. The consonant of the CM is the trigger and the other consonants are the targets of the consonant harmony. In (1), there is agreement in the feature [dorsal] in the singular and [coronal] in the plural.

We understand harmony as ‘a phonological effect in which feature(s) agree over a string of multiple segments’, see Rose & Walker (2011) for a slightly different definition. In this process, at least two segments interact. This interaction may occur locally, or at a distance across at least one (apparently) unaffected segment. Segments can participate in the harmony, they can be transparent or they can block the harmony process. Two possible analyses compete in the literature. First, the autosegmental local iterative spreading rule (Archangeli & Pulleyblank 1994), see 0:

-agrees with

\[agrees with\]

In Tagbana, different harmonies require different analyses.

First, the last vowel of the nominal or adjectival stem harmonizes with the CM’s vowel, see (4). All vowels participate in the total harmony, including the nasal vowels (and the tones). In this case, both simple spreading, from one segment to the next, or a trigger-target analysis, where one trigger is used for several targets, are equally successful since the harmony relation is a simple one, from one vowel to another.

Second, a continuous string of segments of vowels and consonants is involved in nasal harmony (or vowel-consonant harmony). There is an allophonic relationship between \([g], [n]\) (and \([?]\)) in class 1 CM. \([g]\) appears in different environments but not between two identical nasal vowels: in this case, \([n]\) is found, see (5). Total vowel harmony applies first, from V1. In a second step the [nasal] feature that is now found at both sides of \([g]\) spreads to the consonant, that also becomes also nasal. The local iterative spreading rule is more adequate since spreading of nasality is not obligatory.

In addition to these standard processes, Tagbana has a third harmony, a consonant harmony which takes place within a domain larger than a word. Consonant harmony is an assimilation between consonants for a particular articulatory or acoustic property operating at a distance over at least another segment, Rose & Walker (2011). In Tagbana, the harmony takes place between the consonants of the morphemes related to the noun. In (1) for instance, the feature [dorsal]
originates in the trigger consonant, the CM consonant. All morphemes listed above, the targets, agree with this feature.

Here a local iterative spreading analysis makes wrong predictions. The harmony takes place not only across vowels, but also across other consonants, which are featurally specified and the domain is larger than that predicted in local iterative spreading analysis. The consonant harmony is limited by the morphology and it targets only consonants of the nominal domain. In this case, only the non-local trigger-target relation. Besides a presentation of the data, we will discuss the harmony processes data in a formal framework.

(1) a. tí- ñi ki giñi gí gá gè
tree-CM1.SG PRO which PRESENTATIVE this PTC
‘Which tree is this one?’
b. tí- ñí tí diñí dí dá dè
tree-CM1.PL PRO which PRESENTATIVE this PTC
‘Which trees are these one?’

(2) Local iterative spreading rule

\[ \begin{align*}
\alpha & \quad \beta \\
\beta & \quad \gamma
\end{align*} \]

\[ F_1 = F_2 \quad \text{then} \quad F_1 = F_3 \]

(3)

(4) Total vowel harmony: \( V_1 \ C \ V \rightarrow V_1 \ C \ V_1 \)

a. k ã-¿ à ‘village’
b. t i-¿ i ‘tree’

(5) Nasal harmony (Vowel-consonant harmony) \( V_1 \ C \ V \rightarrow V_1 \ C_1 \ V_1 \)

a. kágál ‘jackal’
b. kògù-tjù ‘knee’
c. kògò ‘cat’
d. fù-ŋù ‘anger’

(6) Consonant harmony: \( C_1 V \ldots C \ldots C \ldots \rightarrow C_1 V \ldots C_1 \ldots C_1 \ldots \)
References
**Jochen Trommer**

**Mutual Counterfeeding and Duke-of-York Blocking in Bari**

**Outline:** In this talk, I discuss a neglected type of underapplication, where a derivation is blocked if it would lead to an output homophonous to the input (‘Duke-of-York Blocking’). I show that this type of opacity, which is inherently problematic for rule-based theories, receives a straightforward account in parallel Containment-based Optimality Theory. **Data:** The phrasal tonology of Bari (Eastern Nilotic, Yokwe 1986) is governed by two pervasive processes: Word final H-tones spread to the initial syllable of a following word (e.g. ríp ‘sawed’ + dùpà ‘cradle’ → ríp dùpà, underlining marks multiple association of the same tone), but also trigger dissimilation of word-initial Hs (e.g. dòk ‘fetched’ + kópò ‘cup’ → dòk kòpò). Whereas both processes conspire to derive specific target forms (e.g. dép ‘held’ + kéré ‘gourd’ → dép kéré → dép kéré), their interaction leads to an ordering paradox in a rule-based approach, as shown by Yokwe (1986): H-spreading counterfeeds H-dissimilation in bisyllabic LF inputs (mát ‘drank’ + wìnî ‘medicine’ → mát wìnî *→ mát wání), whereas H-dissimilation counterfeeds H-spreading for bisyllabic HL-inputs (e.g. dòk kòpò → dòk kòpò *→ dòk kòpò). Crucially, what seems to be blocked here are forms that would be pronounced identically to the inputs, blocking a Dukeof-York effect (McCarthy 2003) in phonetic interpretation. **Claim:** I argue that a parallel OTanalysis couched in Colored Autosegmental Containment Theory (Zimmermann and Trommer 2014) straightforwardly resolves the rule ordering paradox, based on the independently motivated assumption that H-dissimilation in Bari is actually not H → L mutation, but OCP-driven insertion of a L between two H-tones. **Analysis:** I assume that tone spreading is triggered and restricted by an undominated set of constraints along the lines of Myers (1997) for Shona, abbreviated here by $\text{PW}_H \text{PW}_H$ (tableau (1)). The OCP constraint marks all pairs of adjacent H-tones (independently of their association). Since the H-tones cannot be deleted or altered due to the Containment restriction on GEN (inputs must be completely contained in the output, Prince and Smolensky 1993, van Oostendorp 2005, Trommer 2011), the only possible repair is insertion of an intervening L-tone, which by virtue of the undominated constraint *T (‘Assign * to every floating epenthetic tone’) must be associated to a TBU even at the cost of phonetically deassociating underlying tones (tableau (2)). Note that the containment-based system straightforwardly captures the opacity of L-epenthesis here. The deassociated final H-tone, although unpronounced, still motivates epenthesis since it remains part of the output. Containment also allows the direct implementation of the intuition that spreading is blocked in a Duke-of-York output via the constraint $]'_{HH}$ (‘Assign * to every TBU which is simultaneously the right edge of two H-tone spans’, tableau (3)). Finally, L-epenthesis would be redundant for LF inputs since the underlying L already separates the two H-tones (tableau (4)). **Discussion:** The Bari data present a type of underapplication which leads to a paradox in a rule-based framework, but can be directly captured in a Containment-based system. This shows that Containment not only imposes inherent restrictions on opacity phenomena, absent in rule-based accounts (Trommer & Zimmermann 2016), but also predicts additional patterns that cannot be captured by strict rule ordering. Crucially, the Bari case is also not amenable to a
paradigmatic output-output account. Constraints on paradigmatic distinctness such as Antifaulthfulness (Alderete 1999) relate different paradigmatically related forms of words, not identical word forms in different phonological contexts. The epenthesis-based analysis of H-dissimilation, if correct, further provides independent support to the claim for tone epenthesis as a default repair for OCP-violations as in insertion-based approaches to downstep (Paster and Kim 2011). Independent evidence for this analysis in Bari comes from trisyllabic H-spreading targets that retain their original H-tone on their final syllable (e.g. déʔ `hid’ + píllí `knife’ → déʔ píllí), which leads to problems for a literal dissimilation account (HH → HL).

(Epenthetic association lines are dashed, phonetically invisible – ‘deleted’ – ones dotted)

<table>
<thead>
<tr>
<th>(1) H-Spreading</th>
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</thead>
<tbody>
<tr>
<td><strong>Input:</strong> = c.</td>
</tr>
<tr>
<td>H</td>
</tr>
<tr>
<td>a. rip</td>
</tr>
<tr>
<td>b. rip</td>
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</tbody>
</table>

<table>
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<tr>
<th>(2) H-Spreading + L-Epenthesis</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Input:</strong> = c.</td>
</tr>
<tr>
<td>H</td>
</tr>
<tr>
<td>a. dep</td>
</tr>
<tr>
<td>b. dep</td>
</tr>
<tr>
<td>c. dep</td>
</tr>
</tbody>
</table>

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<thead>
<tr>
<th>(3) Duke-of-York Blocking: L-Epenthesis without H-Spreading</th>
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</thead>
<tbody>
<tr>
<td><strong>Input:</strong> = c.</td>
</tr>
<tr>
<td>H</td>
</tr>
<tr>
<td>a. dok</td>
</tr>
<tr>
<td>b. dok</td>
</tr>
<tr>
<td>c. dok</td>
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</tbody>
</table>

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<thead>
<tr>
<th>(4) Blocking of L-Epenthesis by Underlying L.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Input:</strong> = b.</td>
</tr>
<tr>
<td>H</td>
</tr>
<tr>
<td>a. mat</td>
</tr>
<tr>
<td>b. mat</td>
</tr>
<tr>
<td>c. mat</td>
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</tbody>
</table>
Eva Zimmermann

The default vs. the underspecified: Floating tones in Zacatepec Chatino

Main Claim I argue that the complex tonal phonology of Zacatepec Chatino follows in an account that contrasts a default L-tone inserted to avoid tone-less TBU’s and TBU’s that remain tone-less in the phonology and are realized with a phonetic default M-tone. These two layers of defaults and underspecification can be easily predicted in an OT-system where an expected default repair can be blocked in certain contexts by a higher-ranked markedness constraint.

Background There are numerous arguments that the phonology of certain languages contrast tone-less TBU’s with tonally specified TBU’s (cf. Hyman, 2011). Analyses then differ in whether those tone-less TBU’s are assumed to remain tone-less in the phonology and are realized with a phonetic default (e.g. Myers, 1998; McPherson, 2011) or whether a phonological default-tone is inserted (e.g. Antilla and Bodomo, 1996; Picanço, 2005). The pattern discussed here extends this typology in employing both concepts of default-tones in one language.

Data The Otomanguean language Zacatepec Chatino (=ZAC, Villard, 2015) has the four lexical level tones low (=L, a₁), mid (=M, a³), high (=H, a⁴), and superhigh (=S, a⁵). L is also the phonological default tone that is realized on all TBU’s that would otherwise remain tone-less as can be concluded from a regular spreading process: Word-final H and S spread to all following tone-less TBU’s (1-a) but M never spreads (1-b). If a tone-less TBU is preceded by an M-toned or tone-less TBU (1-c), it is realized as L. (For tone-less TBU’s following L-tones (1-d), the surface realization as L is ambiguous between L-epenthesis or L-spreading.) In addition to this regular tone spreading, there are several words ending in floating H or LS tones. These floating tones are realized on the rightmost tone-less TBU of the following word (2). Crucially now, potentially intervening tone-less TBU’s are realized with an M-tone. This is highly surprising since one could expect either realization of the default L-tone (*[nkwa] L na M ku L la H] (2-a)) or spreading of the originally floating or stem-final tone (*[nkwa] L na M ku H la H] (2-a)) instead.

Analysis The regular spreading of H and S results from a high-ranked ALIGN-constraint demanding that tones are realized at the right phrase-edge (3-a)+(4). Only M cannot avoid a violation of ALIGN since association of M to more than one TBU is excluded by higher-ranked *LONGM. An otherwise tone-less TBU following M hence receives a default L (5). The ALIGN constraint also predicts that floating tones are realized on the rightmost tone-less TBU (6). In contrast to the contexts in (5), however, tone epenthesis inside the tonal melody of a morpheme is impossible due to a standard morpheme CONTIGUITY constraint (3-b) (Landman, 2002). Intramorphemic tone-less TBU’s hence remain tone-less in the phonology and are realized via a phonetic default M-tone (6). Surface M-tones in ZAC are hence ambiguous and are either realization of an underlying M or a phonologically tone-less TBU. Surface L-tones, on the other hand, are the realization of an underlying L or an epenthetic L inserted in the phonology. The complex behaviour of floating tones in ZAC is hence predicted from standard markedness constraints in an analysis that acknowledges the existence of two layers of default-ness.

Against floating M-tones An alternative analysis assuming that the additional M is also under-
lyingly floating (resulting in floating MH and MLS instead of H and LS) faces several problems. One is that this floating M would associate to all tone-less TBU's preceding the TBU the floating H or LS associates to. However, M-tones do not participate in the general tonespreading process affecting H and S (1-a). Spreading of M to supply tone-less TBU's with a tone would be preferred over spreading H or S in only this context which results in a ranking paradox for the phonology. In addition, the assumption of M as the tone-less default allows a straightforward analysis of a third pattern of lexical tone changes described in Villard (2015) as floating L-tones. The supposedly floating L, however, does not result in a additional L-tones in most contexts but additional M-tones. It is argued that there is no floating L in ZAC and the additional tone changes are simple OCP-effects between L-tones resulting in tone-deletion.

(1) **H/S-spreading and default L-tones and (Villard, 2015, 184+187)**

<table>
<thead>
<tr>
<th>UNDERLYING</th>
<th>SURFACE</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. kwi(^M)na(^H) kula</td>
<td>/M.H/ /X.X/ kwi(^M)na(^H) ku(^H)la(^H) [M.H][H.H] ‘old snake’</td>
</tr>
<tr>
<td>b. yu(^s)in(^L^S) kula</td>
<td>/L.LS/ /X.X/ yu(^s)in(^L^S) ku(^L^S)la(^L^S) [L.LS][S.S] ‘old sea turtle’</td>
</tr>
<tr>
<td>c. ka(^M)kwen(^M) kwila</td>
<td>/L.M/ /X.X/ ka(^M)kwen(^M) kwila(^L) [L.M][L.L] ‘you will vomit fish’</td>
</tr>
<tr>
<td>d. kwana kula</td>
<td>/X.X/ /X.X/ kwa(^L)na(^L) ku(^L)la(^L) [L.L][L.L] ‘old mirror’</td>
</tr>
<tr>
<td>d. jn(^y^)a(^M) ke(^L) kula</td>
<td>/M.L/ /X.X/ jn(^y^)a(^M) ke(^L) la(^L) [M.L][L.L] ‘old hen of yours’</td>
</tr>
</tbody>
</table>

(2) **Realization of floating H and LS (Villard, 2015, 187+223+223)**

<table>
<thead>
<tr>
<th>UNDERLYING</th>
<th>SURFACE</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. kwana(^M)kwa(^H) kula</td>
<td>/X.M (H)/ /X.X/ nkwa(^L)na(^M) ku(^M)la(^H) [L.M][M.H] ‘old thief’</td>
</tr>
<tr>
<td>b. kwa(^M) nkajiyan(^M)</td>
<td>/M (H)/ /X.X.M/ kwa(^M) nka(^M)ji(^H)yan(^M) [M][M.H.M] ‘already I farted’</td>
</tr>
<tr>
<td>c. kwa(^M) nkasa(^L)</td>
<td>/M (H)/ /X.L.M/ kwa(^L) nka(^H) sa(^L)la(^L) [M][H.L.M] ‘already you threw it away’</td>
</tr>
<tr>
<td>d. naten(^L) kula</td>
<td>/X.L (LS)/ /X.X/ na(^L)ten(^L) ku(^L)la(^L) [L.L][L.M.S] ‘old people’</td>
</tr>
<tr>
<td>e. ti(^y)a(^L) nkasa(^L)</td>
<td>/X.L (LS)/ /X.L.M/ ti(^y)a(^L) nka(^L)sa(^L)la(^M) [L.L][L.S.L.M] ‘early you threw it away’</td>
</tr>
</tbody>
</table>

(3) **ALIGN(T,PH):** Assign *\(^\star\) to every TBU intervening between the rightmost TBU a morphologically coloured tone \(\hat{T}\) is associated to and the right edge of the phrase.

**MCONT**: Assign *\(^\star\) to every tone that is not of morphological colour \(\alpha\) and preceded and followed by a tone of morphological colour \(\alpha\).
(4) Spread of $H$

<table>
<thead>
<tr>
<th></th>
<th>$M$</th>
<th>$H$</th>
<th>*LONG/LM</th>
<th>*LONGHS</th>
<th>SPECIFY</th>
<th>DenL</th>
</tr>
</thead>
<tbody>
<tr>
<td>a.</td>
<td>$M$</td>
<td>$H$</td>
<td>5*!</td>
<td>**</td>
<td></td>
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</tr>
<tr>
<td></td>
<td>(kwi na) (ku la)</td>
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<tr>
<td>b.</td>
<td>$M$</td>
<td>$H$</td>
<td>5*!</td>
<td>**</td>
<td></td>
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<tr>
<td></td>
<td>(kwi na) (ku la)</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>c.</td>
<td>$M$</td>
<td>$H$</td>
<td>3*</td>
<td>*</td>
<td></td>
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</tr>
<tr>
<td></td>
<td>(kwi na) (ku la)</td>
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(5) No spread of $M$ but $L$-epenthesis

<table>
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<tr>
<th></th>
<th>$L$</th>
<th>$M$</th>
<th>*LONG/LM</th>
<th>*LONGHS</th>
<th>SPECIFY</th>
<th>DenL</th>
</tr>
</thead>
<tbody>
<tr>
<td>a.</td>
<td>$L$</td>
<td>$M$</td>
<td>5*</td>
<td><em>!</em></td>
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<td></td>
<td>(kakwén·kwila)</td>
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<tr>
<td>b.</td>
<td>$L$</td>
<td>$M$</td>
<td>*!</td>
<td>3*</td>
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<td></td>
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<tr>
<td>c.</td>
<td>$L$</td>
<td>$M$</td>
<td>5*</td>
<td>**</td>
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<td></td>
<td>(kakwén·kwila)</td>
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(6) Floating $H$-tone realization

<table>
<thead>
<tr>
<th></th>
<th>$M$</th>
<th>$H$</th>
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The Role of Expectability and Sub-Phonemic Detail in Speech Perception: English has-clitic /s/ vs. plural /s/

Traditionally, the form of a morpheme is assumed to be phonological in nature. Recent research on American and New Zealand English, however, has shown that non-morphemic and different morphemic and clitic /s/, which are supposed to be the same phonologically, actually differ in duration (Plag, Homann & Kunter 2015; Zimmermann 2016) and that the expectability of a plural given its preceding word has an effect on plural /s/ duration (Rose, Hume & Hay 2015). For some contrasts, the described differences reach well above the perceptibility threshold of 25-30ms (Klatt & Cooper 1975).

The next logical question to ask is whether listeners can make use of these sub-phonemic differences in perception. We will present the results from a visual-world eye-tracking experiment in which we tested the discernibility of plural and has-clitic /s/ in ambiguous contexts. In the experiment, 20 participants listened to recordings of sentences such as My /jips/ appeared in numerous feature films, while seeing the two possible interpretations of /jips/ printed on the screen, i.e. SHIPS and SHIP’S. They were asked to look at the word they heard as soon as they recognized it. This paradigm has successfully been used to investigate the perception of sub-phonemic detail (e.g. Shatzman & McQueen 2006, Derrick & Bürkle 2016).

We tested a total of 192 recordings, i.e. 96 test items and 96 control sentences, by two different speakers, one of which showed the described duration differences while the other did not. The test items contained two different base nouns in three contexts with varying plural expectability rates. Each context was read twice with a plural /s/ and twice with a has-clitic /s/ by each of the speakers. Each recording was rated twice by every participant.

We will discuss how the participants employed duration differences and plural expectability in the distinction of plural and has-clitic /s/. Preliminary analyses of the data of ten participants using Chi square tests suggest that gazes were more on target for items produced by the speaker who showed a difference in /s/ duration than for items produced by the speaker who did not show a difference in /s/ duration, p<0.0001. The final analyses that are to be presented will use generalized additive models to fully factor in the complex non-linear nature of the gaze patterns recorded in the eye-tracking data.

References


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