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Intonation at the phonology-syntax interface in 'phrase languages'

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In the talk I will concentrate on a type of language which has been largely neglected or misclassified in classical typologies of intonation systems, and that I have called 'phrase languages' (Féry 2010). I propose that these languages organize the phrasal melodies around boundary tones (or phrasal tones) and not around pitch accents, as is the case in so-called intonation languages (with Germanic languages as prototypes), or around lexical tones as in so-called tone languages (like in Mandarin or in the Bantu languages). The primary text unit of the tonal organization is thus not the word, but the prosodic phrase, a higher domain in the prosodic hierarchy. Lexical accents and pitch accents may be present but are not as important as in intonation languages and tone languages (compare Jun 2005, Ladd 1996/2008 and Gussenhoven 2004 for typologies of intonation primarily based on word melodies).

Phrase languages are as diverse as French, Georgian, Hindi, Indian English, Korean and West Greenlandic. After showing what classifies all these languages as one class, I will go into some details of their realization under focus and givenness conditions for the four first in the list. Phrasing cues are very important in these languages, and are sensitive to both syntax and semantics. Results of my own recent research on Hindi and Indian English (with Pramod Pandey), on French (with Fatima Hamlaoui and Sascha Coridun) and on Georgian (with Stavros Skopeteas) will be summed up. It will be shown why it is difficult to assume a conventional pitch accent view for the intonation of these languages. But once phrasing is taken into account, results receive an illuminating interpretation.

Mechanisms of phonological learning in adults: the role of features

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Recent years have seen a growing interest in the use of experimental methods to investigate phonological learning mechanisms. I will report on three studies that examine how adults learn novel phonotactic constraints and phonological alternations. The results suggest that adults rely on subsegmental representations, and, moreover, that these representations are categorical in nature. In other words, adult learners appear to extract featural rather than continuous acoustic representations. While these results do not inform us about the mechanisms of native language acquisition, they do provide insight into the psychological reality of phonological features.

Rhythmic Patterns of Prominence in Akan/Twi

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In phonological theory, rhythm is described as the appearance of alternating patterns of prominent elements, e.g. alternating stressed syllables. However, metrical patterns are not so apparent in languages without stress or accent. In particular, how rhythm appears in tone languages without stress/accent is poorly understood. This study explores the rhythmic timing patterns of prominent elements in Akan/Twi, a West African tone language thought to be syllable-timed (Obeng, 1987), using the Speech Cycling Task (Cummins & Port, 1998; Port, 2003; Tajima & Port, 2003). In the Speech Cycling Task, speakers are asked to repeat a phrase several times along with a metronome. Prominent elements, such as stressed syllables in English or word-final syllables in Japanese, tend to occur at simple harmonic phases of 1/3, 1/2, and 2/3 of the fixed metronome period. These positions within the period are termed attractors and previous studies have shown that prominent syllables not only have a tendency to align in time with the attractors, but that these syllables also resist temporal displacement (Cummins, 1997; Tajima, 1998; Tajima, Zawaydeh, & Kitahara, 2001).

In this work, an experiment was devised to understand the prominence relations between syllables in Akan. As the previous literature suggests, all syllables in Akan have equal prominence in both their phonological representation, as well as their production (Abakah, 2005). The first hypothesis tested whether specific syllables in a phrase will align near 1/2 of the repetition period given a two-beat pattern. The second hypothesis was that syllables aligning with 1/2 would align with a different simple harmonic phase given a three-beat pattern. This is empirically verifiable by checking which syllables exhibit the tendency to occur at simple harmonic phases, which were controlled by manipulating the clicks of the metronome to occur at 1/2 of the period (a two-beat pattern), and 1/3 and 2/3 of the period (a waltz-like pattern). Subjects were instructed to align the first syllable of the phrase with the first click of the metronome. This task forces speakers to align prominent elements within the phrase with the clicks of the metronome, which are fixed to the simple harmonic phases. The data include four speakers asked to repeat a phrase eight times along with a metronome whose rate was fixed. The speech materials included 60 phrases ranging from 4-6 syllables in length and four tone melodies (H, L, HL, and LH). Tone was included as a condition since it also hypothesized that H toned syllables will be more prominent.

Results show two patterns of rhythmic entrainment in the two-beat condition. In the first pattern, final syllables of four and five syllable phrases, and the penultimate phrase of six syllable phrases occur near 1/2. In the second pattern, syllables were added to phrases lengthening the phrase by that duration. The phrases in the three-beat condition were repeated with the second pattern. Furthermore, both H and L toned syllables occurred near simple harmonic phases. Implications for the stress-timing/syllable-timing dichotomy and how tonal melodies affect rhythmic patterns are also discussed.

Phonological factors outrank frequency effects: Evidence from Greek stress

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Research on the phonology of novel/nonce words has shown that phonological grammars encode information on lexical frequencies yielding outputs at frequencies that match the lexical ones (see Zuraw 2000, Hayes & Londe 2006). Interestingly, not all types of phonological information are productively enforced in nonce words. Becker et al. (2011) convincingly argue that speakers apply only phonologically-grounded information and dispose of generalizations that lack such motivation. This finding entails that although the grammar absorbs statistical patterns, speakers do not act as blind frequency matchers (e.g., Frazier 1995, Fodor 1998, Zuraw 2007) by reproducing whatever arbitrary generalization grammar throws at them. In this paper, we provide evidence from Greek stress that speakers make choices about the stress patterns they produce on the basis of what is not accentually marked in their language. This suggests that certain phonological factors can blur or even wipe out frequency effects.

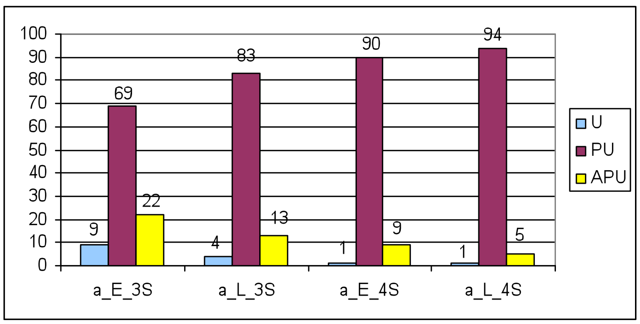
Greek stress is not calculated by means of a rule that assigns prominence on some edgemost syllable or on a syllable of a specific type. Stress assignment is rather the result of interaction between morphemes that carry inherent accentual information. In the absence of lexical stress, prominence is assumed to be on the antepenultimate syllable (Malikouti-Drachman & Drachman 1989) due to a three-syllable window restriction. Although it has been reported that APU is not statistically the favorite stress pattern (Revithiadou 1999), there is – to our knowledge – no experimental study to confirm this assumption (see, however, Protopapas et al. (2006), where it is shown that APU is not the preferred stress choice when speakers read out words that lack the orthographic accent diacritic). Acknowledging this gap in the literature of Greek stress, we designed and carried out a production experiment using nonce words as stimuli. Our goal was to investigate which one of the three possible stress patterns, APU, PU or U, would score high in the speakers' productions.

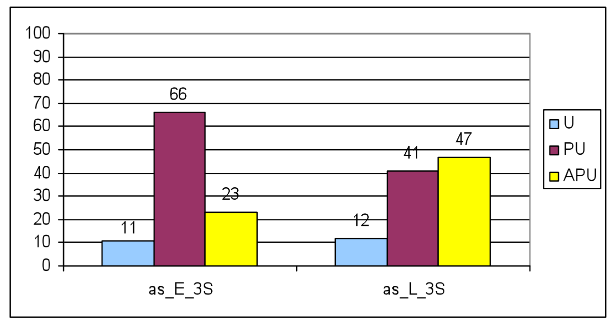
The experimental task involved the production of 150 sentences each one containing a pseudoword. The participants, 32 native speakers of Greek (28 females, 4 males; 21-45 years old; Mean age: 23), were asked to read out 150 SVO sentences, where S was always a pseudoword. Each sentence was introduced with a photo of an unknown item/creature the pseudoword was assumed to denote. The items were controlled for (a) morphological classhood (5 noun classes) and (b) word size (two-, three- & four-syllable words). We collected 4800 items in total which were codified by the experimenters according to speaker, word size and stress pattern. In order to unearth the effect, if any, of the statistical stress patterns of the Lexicon on the speakers' productions, we culled nouns from the most productive nominal classes, namely -*os* (masc/fem), -*o* (neut), -*a* (fem), -*i* (neut) and -*as* (masc) nouns (based on *Anastassiadis-Symeonidis' On-line Reverse Dictionary*, http://www.komvos.edu.gr/ dictionaries/dictOnLine/ DictOnLineRev.htm). These nouns were in turn codified according to their size, syllable structure and, of course, stress pattern and morphological class.

The comparison of the stress patterns produced by the speakers for the tested inflected words with the patterned frequencies of the Lexicon yielded some very interesting results. For instance, *a*-class nouns exhibited a stark match between the stress hierarchy of the Lexicon and the hierarchy revealed by the speakers' productions (see fig. in (1)), namely PU > APU > U. Interestingly, the results also revealed that the speakers' stress hierarchy does not always faithfully reflect the frequency hierarchy of the Lexicon. Our speakers are not simply good frequency matchers; when the Lexicon shows a statistical preference for a marked pattern, as in trisyllabic *as*-words where APU stress was preferred over PU stress, the speakers accommodated their stress behavior by adjusting their outputs towards a less marked (in terms of foot structure) option, namely PU > APU (see fig. in (2)). To conclude, when lexical statistics point to marked stress choices, phonological factors apply to filter them out in favor of more well-formed accentual outputs. Moreover, the experimental results clearly lend support to the assumption that PU is more dynamically present than any other stress pattern in Greek, a finding that future analysis of Greek stress should take into consideration.

Examples - Figures

(1) *stress in 3σ & 4σ pseudonouns ending in -a (%)*   (2) *stress in 3σ pseudonouns ending in -as (%)*





(where E=experiment, L=Lexicon, S=syllable)

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What makes a difference?
Substance, Locality and Amount of Exposure in the Acquisition of Morphophonemic Alternations

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Morphophonemic alternations are among the central issues in phonology but we still know little about what factors drive their acquisition (4). Our focus is on the question what mechanisms are available to the learner and we discuss three factors that might have an influence; we investigated the degree to which learners rely on phonetic substance, locality and amount of exposure in the acquisition of alternations. Previous studies provide limited insights because they describe acquisition in natural languages in which the contribution of a single factor is difficult to investigate since often several factors interfere with each other or they limit the investigation to only one factor in an artificial language. In our study we do multiple experiments with artificial languages to investigate the three aforementioned factors. We found that all factors influence the acquisition of alternations, but to a different degree. Current acquisition models do not take these factors into account although a growing amount of evidence shows the necessity of implementing them: An alternation that is grounded in phonetics – substantively motivated – is learned more easily than an alternation that is not (6; 7; 8). A local dependency is learned with more ease than a non-local one (5). Also, amount of exposure is very important: An alternation the learner is exposed to frequently is learned with the more ease than an alternation that the learner is exposed to infrequently (3). With our experiment we provide evidence that phonetic substance makes an impact even after little input and locality makes an impact after more input, but if both properties are absent the learner is stuck: A local, substantive alternation is easier to learn than a local, non-substantive alternation. A non-local, non-substantive is almost impossible to learn; our learners failed completely.

In order to investigate the mechanisms at work during the acquisition process we used the artificial language paradigm, which allowed us to carefully control our material and the course of acquisition process in that, e.g. all rules are equally accessible (2). 120 German adult participants were exposed to singular and plural forms of an artificial language, where CVC words are singular forms and plural is formed by adding a morpheme consisting either of a front or a back vowel to the stem. The choice of the allomorph was dependent on a fully regular rule. However, the type of rule differed across experimental groups. There were 3 different rules, and each participant was exposed to items following only one of these rules. The first rule (VH) was a vowel harmony in which the choice of the plural morpheme was dependent on the backness of the stem vowel. VH is a local dependency and it is grounded in phonetics. In the second rule (R2) the choice of the same morpheme was dependent on the tenseness and length of the stem vowel. Contrary to VH this dependency is local but not phonetically grounded. In the third rule (R3) the choice of the morpheme was dependent on the sonorancy of the initial consonant. This dependency is neither local nor phonetically grounded.

40 participants have been exposed to one of these rules, respectively, half of them were presented with 50 % plural forms and the other half with fewer plural forms (25%). These conditions were created to investigate the influence of amount of exposure and to catch two different moments during the acquisition of the rule. After an exposure phase with strictly controlled number and type of items participants were presented with new CVC singular items and were asked for plural forms. We measured the ratio of their rule-appropriate answers, results are given in the figure 1 below.

Results show that VH is learned best. Rule R2 is learned less well. After only little exposure, the local substantive alternation is generalized more than the local non-substantive alternation: Initially phonetic substance causes a boost in the acquisition process.

Moreover, in the infrequent condition R2 learners (local non-substantive dependency) do only little better than R3 learners (non-local non-substantive dependency), who perform at chance level. R2 learners who have been exposed to more plural forms, however, then caught up and perform nearly as good as participants from the VH condition. As a second factor the locality was crucial: R3 learners still failed completely. Overall, the amount of exposure plays an important role: The more often the plural forms are presented the better the learning effect.

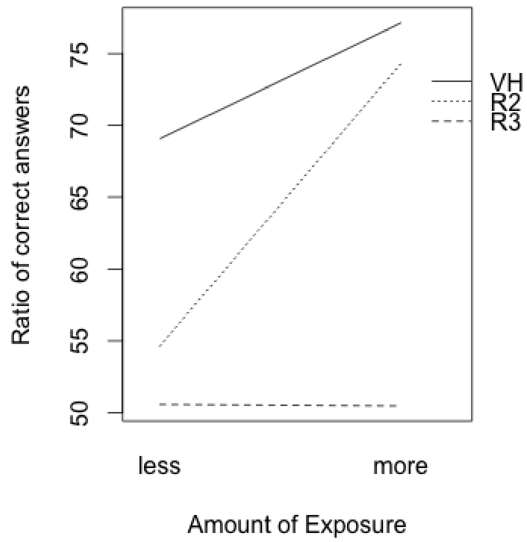

Figure 1: Results

In ongoing work we consider another factor: Note that in these experiments all rules have been fully regular. That is that they applied in all possible cases. It is known, however, that there are rules which are not fully regular, e.g. voicing alternation in German (7) or in Luo (1). Although then the lexicon determines which item alternates and which does not, such regularities are extended to new items (7). The investigation of the above rules VH and R2 in several stati of (ir)regularity will allow new insights to the interaction of supporting factors in the acquisition of alternations that are caught in the highly controlled setting of artificial language paradigm. By the end we hope to provide new facts about what factors drive the generalization of not only regular but also irregular alternations.

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The perception of voicing in fricatives

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bzsu at nytud dot hu mady at nytud dot hu

This study aims to explore how much voicing is needed for an utterance-final alveolar fricative in Hungarian to be perceived as voiced and what other phonetic details cue fricative voicing in this context. Hungarian is not a final-devoicing language, i.e. there are minimal pairs which differ in the voicing quality of the word-final obstruent: mé[z] 'honey' - mé[s] 'lime'. Recent studies show that although there is contrast preservation, utterance-final voiced fricatives are realized with little phonation. In an earlier study (Bárkányi—Kiss—Mády 2009) it has been found that on average 76% of the fricative interval is devoiced in the case of utterance-final /z/, while utterance-final /s/ is unvoiced in 87%. This suggests that in contrast preservation other (secondary) cues such as fricative length, vowel length, etc. play an important role — in accordance with earlier observations in other languages (e.g. Jones 1957; Chomsky & Halle 1968; Wells 1982). In this study we are going to test the role of fricative length and vowel length, more precisely the importance of their ratio in the perception of utterance-final fricative voicing. Since speakers typically talk at different rates, the absolute durations of the segments are highly variable. It has been found, however, for English and German for instance (Port & Dalby 1982, Port & Leary 2005) that the ratio of vowel duration to stop closure or fricative constriction remains rather constant in words with the same voicing feature.

In Experiment 1 we aimed to find out how much voicing is really needed for a fricative in order to be perceived as voiced. Synthesized (HLSyn) *mé*+fricative words were used in which the duration of the segments was identical to the mean duration of the segments in the previous acoustic study. The initial voiced proportion of the final fricative ranged from 0 to 100%, voicing increased in 10% steps. 20 native speakers of Hungarian were presented with a forced choice test (they had to decide whether they heard mé[z] 'honey' or mé[s] 'lime') in Praat ExperimentMFC. The inflection point turned out to be at 30% voicing, i.e. if less than 70% of the fricative interval is devoiced the segment is more likely to be perceived as voiced. (Note that in the acoustic study final /z/ was realized unvoiced in 76% of the fricative interval, vs. 87% in /s/. The question arises whether speakers are sensitive to small amount of voicing (apr. 10%) in this region or it is a mere chance that the inflection point and the results of the acoustic experiment are so close. In order to clarify this point we carried out a second experiment.

In Experiment 2, we tested whether the ratio of the vowel duration and the fricative duration acts as a cue additionally to the amount of voicing in the fricative. In this experiment, both the overall duration of the vowel and the fricative plus the voicing amount were kept constant. Based on the median V + C ratio in the production experiment, the duration of V + C was set at 360 ms. The median V/C duration ratio for unvoiced segments was 0.82 and 1.66 for voiced ones. In this experiment, V/C ratio ranged from 0.57 to 1.77. The minimal segment duration for both vowels and consonants was 130 ms, the maximum 230 ms. The amount of voicing in the fricative was again constant and set to 30% (at this amount of voicing there is exactly 50% chance that a speaker perceives /z/ or /s/.

Target words were again *méz* 'honey' and *mész* 'lime', and stimuli were again synthesised in HLSyn. The perception experiment was run in Praat's ExperimentMFC modul. Our preliminary results show that a voicing amount of 30% in the fricative is not sufficient to enhance the perception of voicing *by itself*. If the V/C ratio was lower than 0.7, participants identified the target fricative as unvoiced, even though it contained 30% voicing. Ratios between 0.7 and 1.0 led to controversial results, ratios higher than 1.0 resulted in the perception of a voiced fricative.

These results show that the V/C ratio that was found to be the primary cue for voicing perception in previous experiments does play a role in categorisation, at least if the amount of voicing is set to a borderline value. It is yet to be tested how the V/C ratio changes if the amount of voicing is set to a lower value that typically enhances the perception of an unvoiced fricative or to a higher value that is perceptually connected to voiced segments

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Infants acquire single-feature representations by holistic learning: Evidence from Dutch infants' vowel perception

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Phonological theory has a long-standing tradition to describe phonemes as feature bundles (Jakobson et al., 1952). Regarding the acquisition of phonemes, Boersma et al. (2003) have proposed that infants first form single-feature representations before combining these into bundled phoneme representations. The alternative hypothesis is that infants initially store clusters of exemplars in which all phonetic detail is preserved (Pierrehumbert, 2003). In the present study we aim at disentangling these two accounts.

The current study tests Dutch infants' perception of the Dutch low vowels /ɑ/ (back and short) and /aː/ (front and long). These vowels differ in the features backness and length. The other combinations of these features, as in [ɑː] and [a], are not phonemic in Dutch. We can thus compare infants' discrimination of a phoneme contrast (/ɑ/–/aː/) to their discrimination of a single-feature contrast that is not phonemic (e.g. length-only in /ɑ/–[ɑː] or backness-only in /aː/–[ɑː]).

We tested 17 11-month olds and 24 15-month olds. The stimuli were synthesized tokens of the Dutch vowels /ɑ/ and /aː/, as well as tokens with the incorrect feature combinations [ɑː] and [a]. All tokens were placed in a [s-k] consonant frame. The syllables were combined into sound strings of 8 syllables that were a repetition of the same syllable; a full-vowel alternation; a length-only alternation; or a backness-only alternation. Half of the children were presented with /ɑ/ as the baseline vowel (repetition: [sɑk - sɑk]; full-vowel: [saːk - sɑk]; length-only: [sɑːk - sɑk]; backness-only: [sak - sɑk]), the other half had /aː/ as the baseline vowel (repetition: [saːk - saːk]; full-vowel: [sɑk - saːk]; length-only: [sak - saːk]; backness-only: [sɑːk - saːk]). Infants were tested in a stimulus-alternation preference procedure (Best & Jones, 1998). On each 10 s. test trial, infants saw a checkerboard pattern and heard a string of syllables. Each of the alternation trials was presented twice and these alternation trials were interleaved with repetition trials.

The assumption in the stimulus-alternation preference procedure is that infants will look longer to the checkerboard pattern on alternation trials than on repetition trials, but only if the alternating sounds belong to different categories for the infants. The effect of an alternation type was therefore quantified as the difference in looking time between the trials with that alternation type and the two surrounding repetition trials. A repeated-measures analysis of variance was performed on these difference scores, with type of alternation (full-vowel, length-only, or backness-only) as repeated measure and baseline vowel (/ɑ/ or /aː/) and age (11 or 15 months) as between-subjects variables.

The analysis showed a significant main effect of type of alternation ($F[2,36]=4.541$, $p < 0.05$) and a significant 3-way interaction between age, baseline vowel and the type of alternation ($F[2,36]=3.397$, $p < 0.05$). No other effect was significant (all $p > 0.3$).

The 11-month olds with the [aː]-baseline looked longer to the full-vowel alternations and quality-only alternations (mean difference scores: 0.054 s. and 0.014 s., respectively) than to the length-only alternations (mean difference score: -0.11 s.). This suggest that Dutch infants consider [ɑ] and [ɑː] as different from [aː], whereas they consider [a] as belonging to the same category as [aː]. The 11-month olds with the [ɑ]-baseline looked longer to the full-vowel alternations and length-only alternations (mean difference scores: 0.075 s. and 0.054 s., respectively) than to the quality-only alternations (mean difference score: -0.10 s.). This suggests that Dutch infants consider [aː] as well as [ɑː] as different from [ɑ], whereas they consider [a] as belonging to the same category as [ɑ]. These results are supported by paired *t*-tests on the difference scores from the full-vowel, length-only, and backness-only trials within the children with the /ɑ/-baseline and the /aː/-baseline.

The experiment was not successful in revealing vowel discrimination in the 15-month old group. We therefore focus on the results from the 11-month olds.

Interestingly, Dutch 11-month old infants' behavior reflects specific properties of their native language, as in Dutch [a] can be a realization of underlying /aː/ and of underlying /ɑ/, whereas neither /aː/ nor /ɑ/ is likely to be realized as [ɑː] in any context.

Our results can be explained well in terms of single-feature representations if we assume that infants specify only certain vocalic features (Fikkert, 2010, following the model of the Featural Underspecified Lexicon, Lahiri & Reetz, 2002). From our results, it appears that Dutch infants have two low vowels in their emerging phonological system: the adult /aː/ is represented as /FRONT/ in the infants' system and is triggered by vowel stimuli with a high F2, namely [aː] and [a]; the adult /ɑ/ is represented as /SHORT/ in the infants' system and is triggered by stimuli with a short duration, namely [ɑ] and [a].

Apart from infants' representations, it is important to consider how these representations may have been learned. Given the realization patterns of /ɑ/ and /aː/ in Dutch, it is possible that during their first year of life, Dutch infants are presented with a cluster of low vowel tokens that share a relatively high F2 but vary greatly in duration. Adults would call this cluster /aː/ and the varying duration causes infants to consider only the high F2 as a reliable cue to this cluster. Similarly, Dutch infants are probably presented with a cluster of low vowel tokens that share a relatively short duration but vary in the F2. Adults would call this cluster /ɑ/ and the varying F2 causes infants to consider only the short vowel duration as a reliable cue to this cluster. To apply such a complex form of distributional learning, infants must take into account all phonetic detail of the incoming vowels simultaneously. Such a learning mechanism is more in line with the holistic phoneme hypothesis than with the single-feature hypothesis.

The present study aimed at disentangling between a single-feature account and a holistic phoneme account of infants' early phoneme acquisition. Based on the results we hypothesize that these accounts cannot be easily disentangled, as single-feature representations may be acquired through a holistic distributional learning mechanism.

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Neutral vowels in Standard vs. Slovakian Hungarian: acoustics and morphophonology

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Background: Front unrounded vowels display unique behaviour in Hungarian front/back harmony: transparency (they are invisible for harmony), anti-harmony (some stems containing only netural vowels take front suffixes, while other stems of the same shape take back ones) and vacillation (the same stem can take front and back suffixes). The traditional claim (cf. Siptár & Törkenczy 2000) is that these stems show no differences in vowel quality, and thus each stem or stem vowel has to be lexically specified for triggering front or back harmony, or vacillation.

Although Hungarian vowel harmony has been in the centre of interest of 'traditional' phonological research (cf. Booij 1984; Clements 1976; Dienes 1997; Esztergár 1971; Hare 1990; van der Hulst 1985; Kontra & Ringen 1986 ff. Kornai 1987; Morén 2006; Ringen 1978 ff., Ringen & Vago 1998 ff., Vago 1976 ff., Zonneveld 1980, *inter alia*) this had mostly relied impressionistic descriptions of the data. Within the recent laboratory phonology paradigm, Beňuš et al. (2004); Beňuš & Gafos (2007) studied the phonetic properties of stems containing neutral vowels in harmonic and anti-harmonic stems and claimed, based on ultrasound and magnetometric evidence from 3 speakers, that the vowels in anti-harmonic stems are pronounced with a more back articulation than the vowels in harmonic stems.

While this study has successfully argued against the traditional position, it fails to answer some questions. First, as Hayes et al. (2009) have shown, the number of neutral vowels at the left edge of the stem has an influence on the choice of the suffix, suggesting that the difference in articulation cannot be the only explanation for the different behaviour of these stems. Second, Kálmán et al. (2011) have shown that there are several degrees of vacillation and transparency, and the morphological identity of both the stem and the suffix has to be taken into account. Third, vacillating stems are unaccounted for.

Research questions: Our first goal was to determine whether and to what extent the articulatory contrast reported by Beňuš & Gafos (2007) is mirrored in the speech stream (recall that Scobbie & Stuart-Smith 2002 have shown that articulatory differences do not always show up in the acoustics). In addition, we set out to investigate whether vowels in vacillating stems pattern with vowels in transparent stems, anti-harmonic stems, or show different behaviour altogether.

Experiments: We conducted two pilot experiments with the same 4 subjects (2 from each dialect). In the experiment determining which stems are vacillating for each subject, the same set of words was presented with both front and back suffixes. Each form appeared in 2 carrier sentences: one consisting of front vowels, the other of back vowels. Participants were asked to choose whether only the front or the back suffixed form or both forms were acceptable.

The acoustic experiment included the words from the first experiment, plus the slightly modified set of transparent–anti-harmonic word pairs used by Beňuš & Gafos (2007). Each word appeared twice in the same carrier sentence, and was presented three times in random order, yielding a total of six occurrences.

Results: In the first experiment, the set of stems deemed vacillating was different for all 4 subjects. There was a strong lexical element visible in the choice of suffixes: words of the shape CaCiCi could either be fully vacillating or fully back. Where the neutral vowel was [E] in the standard dialect, corresponding to [e] in the Slovakian dialect, speakers of the latter had a slight preference for back suffixes compared to the standard speakers. The carrier sentences had no effect on the participants choices.

The findings of the acoustic experiment were partially in line with Beňuš & Gafos's results: harmonic stems containing [i] showed significantly higher F2 than the corresponding anti-harmonic stems. However, the effect was reversed for other harmonicanti-harmonic stem pairs, especially with the non-high vowel ([e] or [E]). Vacillating stems, however, complicated the picture further: they were acoustically indistinguishable from anti-harmonic stems for some speakers, but were consistently pronounced more back than anti-harmonic stems for one standard speaker.

Conclusions: Our findings support the view that contrasts previously thought to neutralise during phonological computation can actually be carried over to phonetic realisation. The dialectal comparison suggests that the difference in phonetic realisation has an influence on the morphophonological behaviour of stems. On the other hand, phonetic behaviour alone is not a sufficient indicator of the phonological behaviour of transparent, anti-harmonic and vacillating stems. While it is clear that much more empirical research is needed to adequately describe the Hungarian facts in their complexity, we believe the data already at hand call for a more sophisticated model of the phonetics-phonology interface than is standardly assumed.

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Using dispersion theory to model and explain the short front vowel shift in New Zealand English

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The short front vowel shift in New Zealand English (NZE) consists of a raising of the TRAP and DRESS vowels (Wells, 1982) and a backing and lowering of the KIT vowel, from front low, mid and high positions, respectively. It is argued here that it is possible to account for these changes using OT constraints based on dispersion theory goals (Flemming, 2004). Dispersion theory uses candidate sets based on sets of phonemes, allowing constraints to be applied to the vowel system as a whole, and avoiding the problem of having to propose constraints that both favour (for example) the TRAP vowel raising towards the 'standard' DRESS vowel, while at the same time disfavouring the 'standard' DRESS vowel in order that it can also raise.

The constraints used in this analysis are: 1) *[LOW SHORT VOWEL], this is based on the dispersion goal of minimizing effort, building on the work of Lindblom (1963) and Crosswhite (2004), where it is argued specifically that short low vowels are more effortful than either longer low vowels or short non-low vowels. 2) *MERGE, (following Padgett, 2003), an instantiation of the dispersion goal that the number of contrasts should be maximized, or that mergers are dispreferred. 3) [MIN EFFORT], an instantiation of the dispersion goal of minimizing effort, and in this case operating to favour any inventory including a mid, central, schwa-like vowel /ə/.

The tableau showing the way these constraints interact to produce the short front vowel shift in NZE is shown below:

	æ, ɛ, ɪ	*[LOW SHORT VOWEL]	*MERGE	[MIN EFFORT]	FAITH
a.	æ, ɛ, ɪ	*		*	
b.	ɛ, ɪ, i			*	***
c.	☞ ɛ, ɪ, ə				***
d.	ɛ, ɛ, ɪ		*	*	*
e.	ɛ, ɪ, ɪ		*	*	**

Raising of the TRAP vowel results from the need to satisfy constraint 1), and the backing and lowing of the KIT vowel results from constraint 3). The centralized KIT vowel in NZE has been described by many commentators as 'schwa-like', despite being stress-bearing, with the result that *woman* and *women* are phonetically identical (Deverson, 1990). Although raising of the DRESS vowel is not specifically motivated by any of the constraints, in the context of a raised TRAP vowel constraint 2) works to avoid the output d. in the tableau shown. It is interesting to note that in the absence of constraint 3), candidates b. and c. are equally favoured, and that candidate b is the inventory usually ascribed to modern Australian English (Watson, Harrington and Evans, 1998).

The current arrangement of the TRAP, DRESS and KIT vowels in New Zealand English, then is due to a combination of the phonetic pressure to avoid low, short vowels and to minimise articulatory effort, while maintaining both existing phonemic contrasts between the three vowels. This analysis represents a novel use of dispersion theory to model a diachronic chain shift, as well as providing an explanation for the short front vowel shift in NZE.

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Vowel quality affects the identification of TSM codas

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Formant transitions and plosive feature are two important factors affecting coda identification in plosive-vowel-plosive syllables. However, none of the stimuli in previous studies contain only formant transitions in the coda position. In this study, we focus on unreleased codas. Thus, subjects are obliged to rely on formant transitions, that is, the interactions between the vowel and consonant resulting from the point of constriction and the nature of the vowel's formants. More specifically, the second formant transition (F2) provides a cue to the place of articulation of the stop. The goal of this paper is to investigate the role that vowels and codas play in perception.

Eleven Taiwan Southern Min (TSM) natives were recruited to identify a coda within a CVC construction, where the onset C varied from /p,t,k/, the vowel V /i,a,u/, the coda C /p,t,k/ and the tone [H/L]. The last 60 ms of the formant transitions (part of C_1VC_X) were cut and re-synthesized with the same C_1V component but different codas (C_1VC_Y or C_1VC_Z), resulting in three variations. There were 3(C-)x3(-V-)x3(-C) x2(tone) x3(variations) =162 stimuli.

Chi-Square tests and cross-tabulation were used to analyze the responses. The results indicate that the vowels /i,a,u/ dominate the coda identification (chi-square=42, $p<.05$), such that the influence from the greatest to least is /i/ > /u/ > /a/. After /-i-/, /-p/ is chosen the most, and /-k/ is chosen the least; after /-u-/, /-t/ is chosen significantly more, and /-p/ is chosen the least. There is no preferred response after the vowel /-a-/. Under the conditions of /-i-/ and /-u-/, the choice of /-p/ and /-t/ is due to the effect of F2. Sequences such as /-k/ after /-i-/ and /-p/ after /-u-/ are least favored because of the difference in F2 between the segments. One may argue that the phonotactic gaps of /ik/, /up/ and /uk/ in TSM may cause this bias. However, the tendency to perceive /-k/ from a manipulated /ut/ suggests otherwise. A lack of preference after the vowel /-a-/ can be explained by the fact that it maintains a relatively intermediate second formant, which results in a difficulty in producing a relatively stable and prominent F2. Additionally, a falling F2 for /at/ and /ak/, resulting in coda /-t/ being the least favored and /-k/ being the most favored (Chu 2009), can also reduce recognition.

keyword: unreleased coda identification, stops, formant transition

Phase-based inhibition of *Raddoppiamento Fonosintattico*. A case study

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Raddoppiamento Fonosintattico (RF) has often been claimed to be the result of the interaction of syntactic and phonological constraints [e.g. Nespor & Vogel 1986]. We present a new set of data from Ariellese (Eastern Abruzzo) showing that neither a purely syntactic nor a purely phonological analysis is sufficient to account for the whole picture. We also argue that an analysis along prosodic constituency and especially so-called prosodic islands [e.g. Ishihara 2007] is redundant, hence unnecessary to account for these data. We show that a purely phase-based account suffices whereby RF inhibition is due to the PIC [Chomsky 2000].

Given the trivial cross-linguistic observation whereby not all syntactically defined boundaries leave a phonological trace, we see that, in Ariellese, the *v*-Spellout boundary, but not the C-Spellout boundary, blocks RF. Whether Spellout boundaries are visible or invisible to the phonology is a parametric choice [Scheer 2009]. Thus the observation of the Ariellese data brings us to the conclusion that there is a phase skeleton which is defined in the syntax, and chunks that are sent to PF may or may not (VP – i.e. the *v*-Spellout – is, TP – i.e. the C-Spellout – is not, in Ariellese) be reflected by a mirror PIC at PF regulating (and blocking, in the case of RF) phonological computation. When they are, PF simply 'mirrors' the Spellout-defined domains, hence making a prosodic-domain mediated mapping algorithm unnecessary.

Data. Unlike in Tuscan, stress plays no role in Ariellese RF: there is no RF of the first consonant of *novə* in *la città novə (lit.* the city new, 'the new city'), for example. RF triggers are thus only lexical: like in other Italian varieties, an unpredictable set of (function) words triggers RF on the first consonant of the following word. The classical analysis (Chierchia 1986), which we follow, is that these words are lexically endowed with extra syllabic space at their right edge, on which the initial consonant of the following word geminates [1] (we use minimal syllabic vocabulary, i.e. only x-slots, in order to keep the analysis as theory-neutral as possible: nothing hinges on particular syllabic representations). However, it is often the case that RF does not obtain even in the presence of a trigger, as illustrated under [2].

Analysis: syntax. In [2], *so* is an RF trigger. However, in (2a) RF does not obtain because of syntactic constraints [Biberauer & D'Alessandro 2006]. Specifically, [2a] is an active construction, whereas [2b] is a passive one. This means that a PIC-defined Spellout boundary occurs between *so* (in T) and *vistə* (in the VP) in [2a] but not in [2b]. This boundary, we claim, is directly mirrored at PF, hence it is visible to phonological operations, in this case blocking RF. Evidence for this analysis is provided by [3], where active *so* triggers RF when occurring in the right syntactic configuration. In [3b], active *so* is a trigger, hence we expect RF to obtain if *so* is within the same Spellout boundary as its complement. Assuming that *so* is in T, we see that in [3a] no RF obtains, given that a syntactic Spellout (*v*-) boundary intervenes between *so* in T and *dittə* in V. In [3b], instead, assuming that *tə* has either cliticized on T or moved to a position higher than *v*, we see that RF suddenly obtains: *so* and *ttə* are in the same Spellout domain, and the boundary between *v* and the VP does not affect them. While the vP phase thus impacts phonology, the CP phase is invisible in PF: RF is never blocked after a wh- word [5]. We conclude that syntactic phases have only an *à la carte* visibility in phonology: it is a trivial observation that most phase boundaries do not leave any footprint in PF.

Apparent counterexample and phonological solution. An apparent counterexample to this PIC-based analysis appears under [4]. Given that prepositions are no phase heads (but see Gallego 2010 for a different view), no Spellout boundary should exist between *pi* (an RF trigger) and its complement. Nevertheless, in [4b] RF does not obtain on the determiner *li* immediately adjacent to the RF trigger. The key for the solution of this puzzle, we wish to claim, is provided by a previously unobserved vowel reduction of [i] (to schwa) in Ariellese. The plural definite determiner *li*, in fact, exhibits an interesting variation: its vowel is realized as [i] when *li* occurs after an RF trigger (like in 4b), but it is realized as schwa [ə] when the preceding word is no RF trigger. This is illustrated in [7]. Since we know that the difference between words that do and do not trigger RF lies in the fact that the former, but not the latter, provide extra syllabic space, the vowel reduction observed must be due to space restrictions: a full [i] occurs in presence of additional space, while schwa is observed in its absence. We therefore conclude that the melodic material of the determiner is lexically unassociated to its skeletal material [7a], and that the [i] is the result of the availability of an extra x-slot [7b]: the lateral elects home in the extra x-slot of the preceding preposition; therefore the two x-slots of the determiner are available for the vowel, and no RF occurs. In case the preposition does not provide any extra x-slot as in [7c], however, the lateral stays home and the vowel is associated to only one x-slot: the result is schwa. In other words, there *is* some kind of RF in *pi li casə*, only is it visible on the following vowel, rather than on the following consonant. The vowel in question is pronounced as [ə] in case it is short (associated to one x-slot); its melodic identity [i] only appears on the surface when it is long (associated to two x-slots). This pattern is known as virtual (vowel) length (Lowenstamm 1991): phonological length (association to two x-slots, consonantal or vocalic) can have a number of exponents on the surface that are not necessarily actual phonetic length. In our case, length distinctions are signaled by vowel quality, i.e. short vowels are neutralized to schwa. The same pattern is found in Kabyle Berber (Bendjaballah 2001, Ben Si Saïd 2010).

[1] gne [k]kullù
with him
x x **x**
| |
ɲ e

[2] a. so vistə
am seen
'I have seen'
b. so vvistə
am seen
'I am seen'

[3] a. tə so dittə
you am said
'I told you'
b. So ttə dittə
am you said
'I told you'

[4] a. pi Ppariggə
for Paris
b. pi li casə
for the-pl houses-pl

[5] chi vvu
what want
'what do you want'

[6] a. pi l[i] casə
for the houses
b. picché l[ə] casə
because the houses
where *picché* is no RF trigger, cf. *picché no*

[7] a. DET li: underlying form
x x

l i

b. after an RF trigger: two x-slots avaibale for the vowel
x x x ← x x
| | ↖ ↑
p i l [i]

c. after a non-trigger: only one x-slot available for the vowel
x x x x
… | ↑ ↑
picch é l [ə]

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Cumulative constraint interaction in syntax-prosody mapping: Evidence from Conamara Irish

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This paper discusses new data from Conamara Irish (CI) which investigates the role of prosodic (rhythmic) constraints on prosodic phrasing, and more specifically, looks at how speakers resolve conflicts between MATCH constraints calling for one-to-one correspondence between syntactic and prosodic constituents (Selkirk 2009, 2011) and prosodic well-formedness constraints. The data suggest that speakers are sensitive to both types of constraints, such that prosodic phrasing reflects the results of a direct interaction between them, as in an Optimality Theoretic framework. However, I argue that in CI, neither constraint type is privileged over the other, as would be expected if constraints are strictly ranked. Rather, the observed phrasing patterns reflect the effects of *cumulative markedness*, such that when choosing the prosodic phrasing for a given sentence, CI speakers opt in favour of structures that incur fewer total constraint violations, rather than those which privilege one constraint over another. These speakers appear to be sensitive to the relative markedness of possible prosodic structures in a global sense, providing evidence that speakers simultaneously attend to both prosodic and syntactic factors when making decisions about prosodic phrasing.

This claim is based on the results of a production study, which investigated phrasing preferences for a set of basic clauses in a neutral pragmatic context for seven native speakers of CI, as evidenced by the distribution of phrasal pitch accents. The sentences (showing default VSO word order) vary the number of words in S and O between two lexical words (Noun+Adjective) and one (noun only), as in (1), to give a set of four minimally-contrastive sentences.

Syntactically, VSO sentences in CI have the structure [V[SO]], such that the S and O form a syntactic constituent distinct from the verb (McCloskey 1996). Assuming that prosodic domains may be recursive (among others, Selkirk 2009, 2011; Ito & Mester to appear; Wagner 2010), we predict that MATCH constraints will prefer structures where prosodic phrasing preserves this constituency, as in (V(SO)). MATCH constraints compete with a prosodic constraint STRONG-START (Selkirk 2011), which disfavours structures with initial weak elements, like V in (V(SO)). This constraint prefers the phrasing ((VS)O), which phrases the verb with the subject, violating MATCH.

It was found that speakers agree in phrasing in most contexts, but show variation when there is no single candidate that is clearly optimal. As shown in the tableaux in (2), speakers uniformly produced those prosodic structures which incur the least number of total violations of MATCH and STRONG-START: in favour of MATCH in tableaux a and b, but in favour of STRONG-START in c. As for tableau d, the tied structures were equally well attested among speakers, suggesting that both candidates are available.

These results support the claim that prosodic phrasing is sensitive both to syntactic constituent structure (Match constraints) and prosodic well-formedness constraints. Moreover, the direct, global interaction between constraints typical of a weighted constraint framework like Harmonic Grammar (Legendre et al. 1990; Smolensky & Legendre 2006; Pater 2009; Jesney 2011), as observed in CI, suggests that neither type of constraint is necessarily privileged: attested phrasings represent the best possible compromise between preserving information about syntactic constituency and creating well-formed prosodic structure.

(1) Cheannaigh múinteoirí (banúla) málaí (bána).
bought teachers lady-like.PL bags white.PL
'(Lady-like) teachers bought (white) bags.'

(2) Competitions and winners in all four members of VSO paradigm (attested phrasings are indicated by ☞)

a. S and O are binary (N+A)

[V [[N A] [N A]]]	STRSTART	MATCH
a. ☞ (V ((NA) (NA))	-1 (V!)	
b. (((VN)A) (NA))		-2

b. S is binary, O is non-binary

[V [[N A] N]]	STRSTART	MATCH
a. ☞ (V ((NA) N))	-1 (V!)	
b. (((VN)A) N))		-2

c. S is non-binary, O is binary

[V [N [N A]]]	STRSTART	MATCH
a. ☞ ((VN) (NA))		-1
b. (V (N (NA)))	-2 (V!N!)	

d. S and O are non-binary (variation)

[V [N N]]	STRSTART	MATCH
a. ☞ (V (NN)	-1 (V!)	
b. ☞ ((VN) N)		-1

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A phonetic study of *l*-deletion in Hungarian

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The aim of this talk is to discuss a phonetic study of coda-*l* deletion in Hungarian and clarify some of the issues that *l*-deletion raises. The phenomenon of *l*-deletion in the coda is a frequent, but optional process in Hungarian (see e.g. Kiefer 1994, Siptár and Törkenczy 2000). Phonological variables affect the variation that underlies this process, but the empirical study of these factors is impossible without a phonetic methodology to distinguish *l*-ful and *l*-less environments. Most existing treatments so far have had to limit themselves to brief descriptions of the phenomenon based on introspective judgments. The absence of descriptions drawing on actual phonetic data may be a consequence of the difficulty of identifying the phonetic cues of *l* in preconsonantal and prepausal position: coda *l* in Hungarian appears to have a highly glide-like quality and is therefore mainly cued by dynamic patterns in formant transitions, with no clear boundaries or static cues. We have developed a novel methodology to investigate the phonetics of coda *l* in this study and applied it to data obtained in a small experiment to shed light on certain aspects of *l*-deletion in Hungarian.

The data that serve as the basis of the study were collected and processed as follows. We elicited sentences containing potential [ɒl] and [ɛl] sequences in preconsonantal and prepausal position (the *lateral* group) along with corresponding control-sentences containing only the vowels [ɒ] and [ɛ] (the *non-lateral* group) from three male speakers of Standard Educated Hungarian. The quality of the consonants following the target sequences was recorded as an independent variable. The 308 target sequences were extracted manually in Praat, and an automated script took 50 measurements of F1, F2, F3 and intensity values at even intervals from the beginning of the ɒ/ɛ(l) sequence to the beginning of the following segment, yielding numeric sequences representing the formant and intensity trajectories; the duration of the sequences was also recorded.

We used two further methods to construct more easily interpretable representations of the trajectories. First, a Discrete Cosine Transform (DCT; Rao and Yip 1990) was performed on the sequences, returning three coefficients correlated with the *mean*, the *slope* and the *curvature* of the trajectories. The values obtained through DCT can be subjected to standard statistical tests such as ANOVA or multiple regression when evaluating differences between groups. Second, graphic representations were produced using Smoothing Spline ANOVA (SS ANOVA; Gu 2002), which maps a group of curves to a single smoothed curve. When several groups are compared, the test provides a confidence interval for each of the groups of curves; the curves can be considered significantly different in places where the intervals do not overlap.

The DCT and SS ANOVA representations were first used to establish which phonetic parameters serve as reliable cues to the presence of coda *l*. Since we had no information about *l*-fulness in individual tokens, all of the results below are derived from the trivial assumption that the lateral group contains more *l*-ful forms than the non-lateral group. This assumption has the following corollary: if a given trajectory contains cues to *l*, it will be different across the lateral and non-lateral groups. This was first investigated by performing multiple regressions and ANOVA's with the DCT representations for F1, F2, F3 and intensity as independent variables. Significant effects of group membership were found for the mean and the curvature of F1, and the mean of F2. The effects on F1 can also be seen in the SS ANOVA representations in Figure 1, which show smoothed curves for several environments in the lateral and non-lateral groups. The robustness of the curvature of F1 receives further support from the fact that the distribution of lateral tokens along the dimension of F1 curvature subsumes that of the non-lateral tokens (Figure 2). This indicates that the lateral group contains both *l*-ful and *l*-less tokens, which are spread out along the dimension of F1 curvature, as opposed to the non-lateral group, which only contains *l*-less tokens. To sum up, F1 mean, F2 mean and especially F1 curvature appear to be reliable cues to *l*.

After establishing the cues to *l*, we investigated a number of potential hypotheses about *l*-deletion. We first looked at the claim that *l*-deletion entails compensatory lengthening of the preceding vowel. A multiple regression with the duration of the sequence as the independent variable showed that duration is significantly different between the lateral and non-lateral groups, and an inspection of the distributions for the two groups also revealed that there is little overlap between them, suggesting that even *l*-less tokens within the lateral group are longer than corresponding tokens within the non-lateral groups. The second hypothesis concerns the gradience of *l*-deletion. An inspection of the distributions in Figure 2 shows that the tokens in the lateral group form a unimodal normal distribution along the dimension of F1 curvature, suggesting that the lateral tokens show varying degrees of *l*-fulness without any categorical effects. Finally, we looked at the effect of the following consonant on *l*-deletion. This is illustrated in Figure 3, which compares kernel estimates for the distributions of F1 curvature values in the lateral and non-lateral groups before [r], [s], [t] and a pause (indicated by *w*). The two groups are almost identically distributed before [t], slightly different before [r] and [s] and rather far apart prepausally, which suggests that *l*-deletion is most likely before [t], followed by [r] and [s] and least likely before a pause.

In conclusion, the pilot study presented here introduces novel methods for investigating the behaviour of coda *l*, establishes F1 curvature, F1 mean and F2 mean as reliable cues to *l*, and confirms the hypotheses that (i) *l*-deletion causes compensatory lengthening of the previous vowel, (ii) *l*-deletion is gradient and (iii) the extent of *l*-deletion is influenced by the phonetic environment. We intend to pursue this line of research further and use the same methodology in a larger-scale experiment, which will make it possible to test additional hypotheses about *l*-deletion (e.g. claims about *l*-vocalisation and frequency effects) and refine the results of the pilot study.

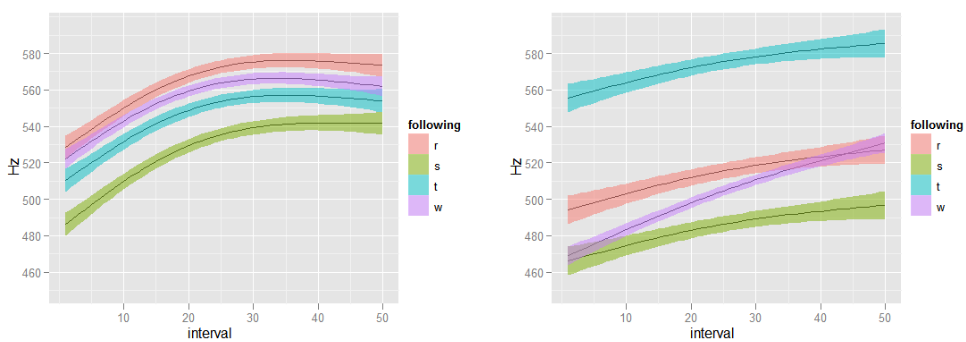

Figure 1: *left*: lateral F1 curves; *right* non-lateral F1 curves

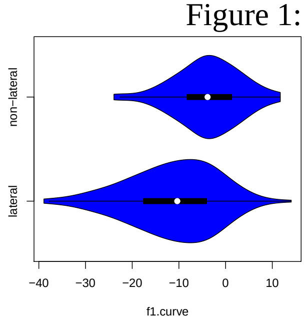

Figure 2

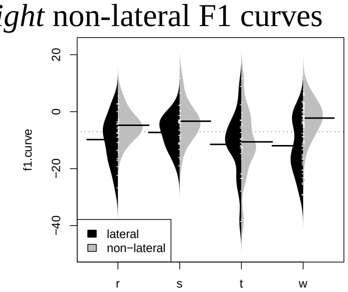

Figure 3

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Assibilation in Standard Finnish: a case of stress-conditioned contrast neutralization

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1. Introduction

This paper analyzes the phenomenon of assibilation in Standard Finnish verbs. Its aim is twofold: to provide a new analysis of the phonological process, and to present a case study of the interaction between stress and segmental processes.

Finnish word stress is assigned by laying down left-headed, left-aligned feet, with main stress on the leftmost foot. Assibilation applies to stem-final /t/ before /-i/ across a morpheme boundary. It is blocked in immediately post-tonic position, (1a), optional following a post-tonic segment, (1b), and obligatory if the /ti/ sequence is further away from stress, (1c).

(1) Distribution of Standard Finnish assibilation (data from Anttila 2003:6)
a. /vetä-i/ [vé.ti] *[vé.si] 'pull-past' b. /vuota-i/ [vúo.ti] ≈ [vúo.si] 'seep-past'
c. /kaart-i/ *[káar.ti] [káar.si] 'veer-past'

Anttila (2003, 2007) proposes a metrical analysis of assibilation: assibilation applies to extrametrical /t/, (2b-d). This distribution is argued to result from Positional Faithfulness (Beckmann 1998; Pos-Faith) to segmental features occurring within the stressed foot (2a-b).

(2) Assibilation and metrical structure (data from Anttila, 2007: 12-3)

a.	(vé.ti)	μ.ti	b.	(húu).si ~ (húu.ti)	μμ.ti
c.	(káa)r.si	μμμ.ti	d.	(pá.ran).si	σ.σ.ti

I argue that while assigning stressed feet a positional privilege allows deriving the distribution of assibilation, it has major consequences for the predicted factorial typology of Pos-Faith effects.

2. The problem

The positional privilege attributed by Pos-Faith to stressed positions results in their ability to resist phonological processes. The positional privilege is implemented in the grammar by the action of Pos-Faith constraints ($Ident_{\varphi}(F)$), where F represents any phonological feature (in this specific case [±strident]). It is therefore predicted that any phonological feature can show Pos-Faith effects, if it occurs in a stressed position.

A study of documented cases of stress-conditioned processes (a.o. González 2003) reveals a different picture. Duration aside, among consonantal features stress-sensitive processes target only a small subset of laryngeal and manner features (laryngeal F: aspiration, glottalization, [±voice]; manner F: [±cont], [±strident], [±delayed release]); most consonantal features (e.g. laryngeal F: breathy voice, creaky voice, ejection; manner F: [±nas], [±lat]; place F: [lab], [cor], [dor]) are never the target of stress-conditioned alternations.

Any Pos-Faith analysis of prosodic conditioning therefore predicts many non-attested cases of Pos-Faith to any feature within the stressed foot. It therefore faces the challenge of restricting the set of features which can be targeted by stress-conditioned processes.

3. The proposal in a nutshell

I propose that the effect of stress on Finnish assibilation is consistent with a more restrictive, phonetically based analysis. I argue that assibilation in Finnish is a process of contrast neutralization, triggered by the perceptual similarity between the frication noise of coronal stops before /-i/ and the frication of a sibilant fricative (e.g. Hamman & Velkov 2005; H&V).

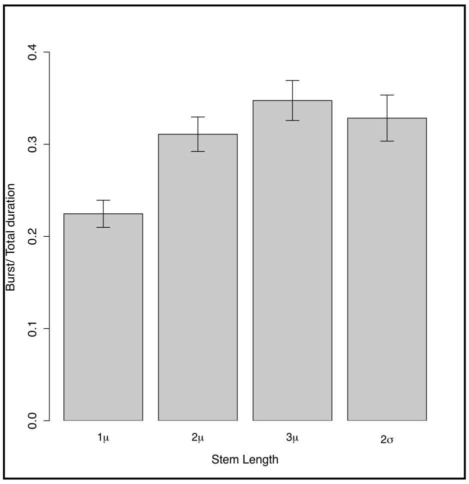
Finnish stress is realized by variations in segment duration: segments have longer durations when they constitute the first or second mora of a word (Suomi et al. 2003). I hypothesize that in Finnish the stress conditioned distribution of assibilation is determined by the phonetic properties of segments in these positions, (3).

(3) Hypothesis: Consonant lengthening after a monomoraic first syllable increases the closure duration and decreases the ratio of burst/total duration. Coronal stops in this position are more ‘stop-like’ than their far-from-stress counterparts (μμ.ti and μμμ.ti).

4. Acoustic Study

An acoustic analysis of Finnish /ti/ sequences in different prosodic positions was conducted to test the hypothesis. Six native speakers of Standard Finnish were recorded in a sound attenuated booth. The speech material consisted of 27 Finnish nouns, which were declined for one of the following case in order to contain the /-ti-/ sequence: Nom-Sg, Nom-Pl, Gen-Pl, Pl-Ess. Non-/e/-nominals were chosen as the recording materials, since /ti/ sequences in these nouns never undergo assibilation. Nouns had a monomoraic, a bimoraic, a trimoraic, or a disyllabic stem. Filler items included in the speech material were Finnish words with the same syllabic structure. Words were read in isolation. Two acoustic properties of the target words were measured: closure duration and burst duration.

Results show that consonant lengthening in post-tonic position primarily affects the closure, decreasing the burst/total duration ratio, (4).



(4, *right*) Effect of stem length on the burst/total duration. Averages across subjects.

5. Perceptual explanation and analysis

The results support the hypothesis in (3). Coronal stops are most stop-like after a monomoraic stem (i.e. immediately post-tonically). I claim that segments in this position are targeted by constraints enforcing durational prominence (‘$D_{dur} \geq X$). These constraints enforce an increase in closure duration. They create a /ti-si/ contrast that is distinct enough to be preserved by increasing the perceptual distance between /ti/ and /si/. In non stress-adjacent position (μμμ.ti, σ.σ.ti) on the contrary, no prominence constraint enforces consonantal lengthening: the stops in these contexts have a large burst/total duration ratio. The high frequency frication noise occupies a longer fraction of the stop. In these contexts, the /ti-si/ is not distinct enough to be preserved, and it is neutralized through assibilation.

A perceptual experiment is currently being conducted, to test the whether indeed the perceptual explanation of stress effect, i.e. whether /ti/ sequences whose acoustic properties mirror post-tonic /ti/ are discriminated more easily from /si/ sequences, than /ti/ sequences whose acoustic properties are those of far-from-stress /ti/.

The formal analysis of this process is cast in terms of a scalar OT grammar in which constraints enforcing metrical prominence interact with constraints incorporating fine-grained phonetic detail and MINDIST constraints evaluating surface contrasts (Flemming 2001). Optional assibilation after bimoraic stems is derived through variable assignment of constraint weights.

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The role of durational cues in the perception of voicing in strident fricatives

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1. Introduction

This paper analyzes the distribution of voicing contrasts in strident fricatives as arising from the different availability of durational cues to the s-z contrast in different contexts. We provide experimental evidence for the importance of duration as a cue to voicing in fricatives (Exp. 1) and for an asymmetry in the perception of fricative duration in initial vs. final position (Exp. 2). Experiment 2 supports a new interpretation of the typology of voicing neutralization in fricatives.

The cross-linguistic distribution of voicing contrast in strident fricatives is summarized by the following implicational hierarchy of contrast neutralization: No Contrast V_V → No Contrast V_# → No Contrast V_#. Although the typology is similar to stop voicing (Steriade 1997), its explanation is rather different because the nature of the cues to voicing is rather different in fricatives. We show that a voicing cue specific to the s-z contrast, the duration of the fricative, has a built-in perceptual asymmetry that explains the typological data.

2. Cues to voicing in strident fricatives

Experiment 1 sought to identify the acoustic properties that cue voicing distinctions in intervocalic fricatives. We conducted a two alternative force choice identification task, similar to Raphael's (1981) work on the acoustic cues to stop voicing in American English. In order to investigate the contribution of individual cues to the perception of voicing in alveolar fricatives, we hypothesized that when a listener is presented with a stimulus which is overall ambiguous but contains one salient cue pointing him to one voicing category, e.g., [+voice], he/she will be prone to systematically categorize the stimulus as being [+voice] because of the high perceptibility of that cue. In contrast, when the listener is presented with a stimulus which is overall ambiguous but contains a marginal cue pointing him/her to one voicing category, e.g., [-voice], he/she will categorize the stimulus as being sometimes [+voice] and sometime [-voice], because the marginal cue is not salient enough to override the overall ambiguity. The relative strength of cues was therefore assessed by investigating how much a change in one cue would shift the perception of an ambiguous fricative.

The following single variables were edited: V1 and V2 duration (V1 dur; V2 dur), frication duration (fric. dur), F0 value in V1 and V2 (F0 V1; F0 V2), F1 and F2 in V1 and V2 (F1,F2/V1; F1,F2/V2). The effect of voicing on the perception of the fricatives was tested by adding voicing to the voiceless frication of the ambiguous base stimulus on a continuum from 10- to 50%. For instance, a stimulus containing a 10% voiced frication was obtained by multiplying the voiceless frication of the base with the voiced frication of [aza] reduced by a fraction of 1/10 (0.1*z).

Listeners were asked to identify stimuli as containing intervocalic [s] or [z] in a forced choice categorization task. Native English speakers (N=19) participated to the study.

An analysis of perceptual saliency, measured by *d'* (Macmillan & Creelman 2005) was conducted in order to calculate the perceptual weight of each cue. The *d'* analysis revealed that among the single-edited dimensions, durational cues in the frication and in the preceding vowel are most salient to the listeners; among the more complex manipulations, combined vowel cues (joint editing of F1 and F2) and frication voicing are the most informative cues to the perception of voicing in the fricatives. These results are shown in Fig. 1.

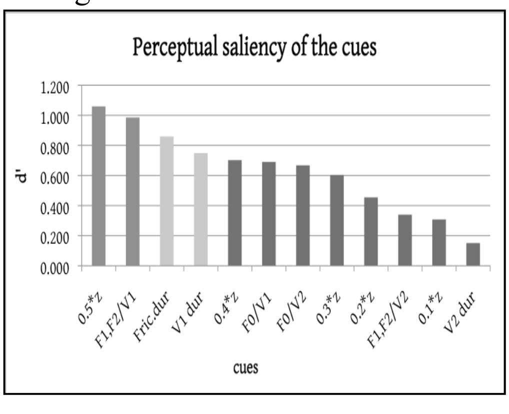


Fig 1: Relative perceptual weight of the edited cues (averages across subjects)

3. Contextual to voicing and the Licensing by Cue Hypothesis

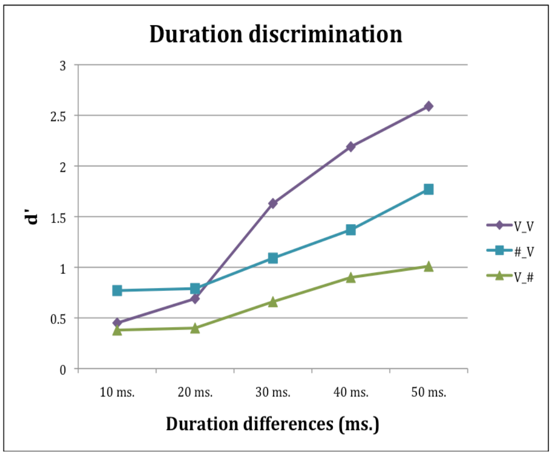
The Licensing by Cue Hypothesis (LCH, Steriade, 1997) predicts that the context where a contrast is more likely to be preserved is the most informative context about that contrast. Indeed, differences in frication voicing and duration are more reliably assessed in the V_V context than in V_#, #_V. LCH seemingly fails though to predict the asymmetry between the word edges. Our proposal addresses this issue and makes a LC analysis available.

Experiment 1 indicates that frication voicing and frication duration are the single most effective perceptual correlates of the voicing contrast in fricatives. In order to establish a tighter connection between the perceptual data and the phonological typology, Experiment 2 explores the asymmetry between the #_V context and the V_# context.

4. Perception of voicing at the edges

The experimental hypothesis is that fricative duration is more reliably perceived in #_V than in V_#. A two alternative forced choice discrimination task was conducted on 21 native speakers of American English (age 24-30) to test this hypothesis. Stimuli were pairs of words containing a fricative in initial, medial or final position. The difference in frication duration between members of the pair, S1 and S2, was 0 to ±50ms. The effects of fricative position on the ability to discriminate frication duration, in *d'* values, are shown in Fig. 2: the discriminability of frication duration is significantly worse in word-final position than in word-initial or intervocalic contexts.

Fig 2: Ease of discrimination as a function of Δt between S1 and S2 (averages across subjects)



A preliminary acoustic analysis of fricatives at the word edges reveals a possible acoustic basis for this perceptual effect. Strident fricatives are realized differently at the two edges of the word. In word-initial fricatives the frication noise rises more abruptly than it decreases at the end of the word. Initial frication is therefore delimitated on the left edge by the sharp intensity rise, and on the right edge by the transitions to the following segment. Final frication on the contrary is delimitated on the left edge by the transitions from the preceding segment, and on the right the tailing off of the noise causes the edge to be blurrier. These loudness differences could be responsible for the availability of better duration discrimination in word-initial segments (a.o., Kato et al. 1997, Kawahara 2007).

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The strangeness of *verhauchung*: coda lenition-inhibition and the effect of phonological structure on the innovation of phonological change

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This paper's starting point is the following question: how can lenitions pattern in terms of their phonological environment? This is a classic issue in historical phonology and has been built into phonological theory in models which focus on representation, such as Government Phonology and CVCV Phonology, and in Optimality Theoretic work dealing with 'positional faithfulness'. I focus on two underdiscussed lenitions which seem to pattern very oddly. I show that, despite appearances to the contrary, these phenomena in fact fully fit in with our theoretical expectations, once other aspects of the phonology of the languages into which they were innovated are properly understood. The steps taken to reach this understanding have substantial implications: they support (i) the unification of [h] and 'aspiration' (eg, Lass 1976, Davis & Cho 2003), (ii) the Laryngeal Realist position on the featural specification of obstruents in 'aspirating' languages (Iverson and Salmons 1995, Honeybone 2005), and (iii) the controversial claim that language-specific phonological structure can influence the innovation of phonological change.

Lenition theory groups together several types of process which all pattern in the same way: they freely occur in 'weak' positions, and are much less common in 'strong' positions. For this distinction to have any value it must be implicational and predictive, such that, if a lenition *does* occur in strong positions, it must also occur in weak positions. Following, Ségéral & Scheer (2008) this environmental distinction can be summarised as in (1).

(1)

strong	weak	
[#__] [c.__]	[__.c] [__#]	[v__v]
initial/onset	final/coda	intervocalic

Lenition processes include spirantisation, sonorisation and debuccalisation. I focus here on debuccalisation, specifically on cases of *verhauchung* (the debuccalisation of fortis fricatives to [h]). Many cases of *verhauchung* comply unexcitingly with (1). Spanish *s*-debuccalisation illustrates this well: it occurs either (i) only in 'weak' coda position, as in Southern Peninsula-Spanish (s → h only in words like *pastel* pa[h]tel 'cake', *vamos* vamo[h] 'let us go'), or (ii) across the board, in both 'strong' and 'weak' positions, as in New Mexican Spanish (s → h *also* possible in words like *cemento* [h]emento 'cement', *casi* ca[h]i 'almost'). In this paper, however, I consider two cases of *verhauchung* which seem to be in direct conflict with (1): Proto-Germanic *x*-debuccalisation and Mid-Scots *θ*-debuccalisation.

Proto-Germanic /x/ underwent debuccalisation to [h], as in (2), the details of which are largely taken from Prokosch (1939) and Voyles (1992). This debuccalisation occurred in 'strong' initial position (and 'weak' intervocalic position), but not in 'weak' coda position.

(2)	Proto-Germanic	Germanic languages	
	xurnan	horn (Old English)	'horn'
	teuxanan	tsiohan (Old High German)	'to pull'
	xlaupan	hleapan (Old English)	'to run'
	naxt	naxt (Old Saxon)	'night'
	falx	falx (Gothic)	'hide' (3.sg.pret)

In Mid-Scots *θ*-debuccalisation, what was /θ/ in Older Scots is now variably pronounceable as [h]. It is recorded in traditional dialect description (eg, Wilson 1915, Wettstein 1942, Zai 1942) and current variationist description (Johnston 1997, Stuart-Smith & Timmins 2006), as in (3). This debuccalisation again occurred in 'strong' initial position, but "[f]inal /θ/ is retained everywhere" (Johnston 1997, 507).

(3)	θ-	[h]ink (Glasgow)	*think*
	θw-	[hwɛŋz] (Berwickshire)	*thongs* < OE *þwang*
	θr-	[hriː] (Perthshire)	*three*
	-θ-	no[h]ing (Glasgow)	*nothing*
	-θ	ba[θ] (Glasgow	*bath*
	-nθ	mon[θ] (Glasgow)	*month*

Both these cases of *verhauchung* seem clear counterexamples to the implicational hierarchy of environments in (1) – if there is no alternative explanation for their patterning, one of the central foundations of lenition theory is demolished.

I argue here that there *is* an explanation for their patterning: the debuccalisations themselves are context-free, innovated to pattern across the board, in both 'strong' and 'weak' environments; however, this conflicts with an already existing aspect of the languages' phonology: [spread glottis] is forbidden in codas. High-ranked *CODA/[spread] is active in Proto-Germanic if we assume (as is commonly done) that the language's fortis plosives were aspirated on the surface, and that this derives (under the assumptions of Laryngeal Realism) from an underlying [spread] specification which surfaces unless *CODA/[spread] forbids it, giving the language the typical Germanic surface distribution of aspiration. Although some varieties of Scots may lack stop aspiration, high-ranked *CODA/[spread] is needed to forbid the occurrence of /h/ in codas (as in all varieties of English), if we assume that /h/ simply comprises a [spread glottis] specification. This analysis is compatible with the Spanish data: Spanish has neither /h/ nor stop-aspiration, so *CODA/[spread] will not be important in the language's phonology, and thus does not inhibit *verhauchung* in codas.

On this analysis, the assumption that lenition processes obey universal environment hierarchies, as in (1), can be retained. More fundamentally, the claim that language-specific phonological structure can affect the innovation of phonological change (implied in Kiparsky 2003, but denied in Hale 2003) is strengthened – if *CODA/[spread] is high-ranked, *verhauchung* seems to pattern oddly; if not, *verhauchung* patterns as lenition is expected to.

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Valencian Vowel Harmony at the Interface

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Valencian vowel harmony is a phenomenon by which the [RTR] mid vowels /ɛ/, /ɔ/ in stressed position spread the features Front and Round to the final unstressed vowel /a/ (e.g. *terra* /ˈtɛɾɾa/ [ˈtɛɾɛ] 'land', *cosa* /ˈkɔza/ [ˈkɔzɔ] 'thing'). In the prototypical case both /ɛ/ and /ɔ/ trigger feature spreading to posttonic /a/. In some varieties, though, only one of the vowels triggers the process. We will focus here on two varieties of the Northern Valencian dialect: the variety of Borriana, which shows Round harmony in the context /ˈɔ/+/a/, and the variety of the nearby town of Nules, which only displays high levels of coarticulation in the same environment. These varieties, and in general the Northern Valencian dialect, are especially relevant to the study of Valencian vowel harmony because the [RTR] mid vowels are not extra-open (unlike Southern dialect vowels; cf. Recasens 1991, Carrera & Fernàndez 2005). Therefore, Northern harmonic varieties seem to provide evidence against the hypothesis that vowel harmony is essentially ruled by articulatory constraints, i.e. by the extreme similarity between the trigger —the [RTR] mid vowels— and the target —the low vowel (this view is suggested, for instance, by Recasens 1991 for the Southern dialect).

In this paper we will analyze, firstly, the realization of the stressed [RTR] mid vowels /ɛ/, /ɔ/ and the realization of /a/ in posttonic final position in potentially harmonic words such as *terra* or *cosa*. Secondly, we will study the same sequences of vowels across morphological boundaries, as in *perd-la* 'lose her' or *correspon-la* 'reply to her', and across words, as in *perd la casa* 's/he loses the house' or *el sol la desgasta* 'the sun wears it (fem.) out'. The main goal of the study is to extract the formants of the vowels to describe to which extent the combination of mid [RTR] vowels and /a/ affects the values of both the stressed and the low vowels and to measure the degree in which the presence of morphological and word boundaries affects the intensity of the assimilation. To this end, we have checked the production of 7 speakers of each variety (Borriana and Nules). The tokens have been registered with a digital recorder (Zoom H4) and a Condenser Cardiod Microphone (AKG-C520L), with a frequency range of 44.1 kHz and 24 bits/sample. The formant analysis has been carried out with Praat (5.0.40), using the Burg algorithm and measuring the formant values at the temporal midpoint of the vowels. Statistical significance has been assessed by submitting the data to a series of one-way ANOVAs (using SPSS).

The results show that there is indeed Round vowel harmony in the context /ˈɔ/+/a/ in the Borriana variety. The assimilation, total within the word (e.g., *cosa* [ˈkɔzɔ]), is less regular across major morphological boundaries: in the clitic group *correspon-la* /koɾɾesˈpɔn#la/ we find either total assimilation of the last vowel, as in *cosa*, or high levels of coarticulation between /ˈɔ/ and /a/, similar to those regularly detected in the environment /ˈɔ/+/a/ in Nules, both within the word and across morphological boundaries. Across words, both varieties display high levels of coarticulation between the stressed vowel and the initial low vowel. Contrarily, in the context /ˈɛ/+/a/ (e.g. *terra* [ˈtɛɾa̟]), neither in Borriana nor in Nules is there a fronting of /a/ comparable with the rounding of /a/ in the context /ˈɔ/+/a/. In the two harmonic contexts, /ˈɔ/+/a/ and /ˈɛ/+/a/, though, /a/ is distinctly more closed in both varieties than unstressed /a/ in the non-hamonic environment /ˈa/+/a/ (e.g. *casa* [ˈkaza] 'house'). Considering all the contexts together, there seems to be a gradation from height leveling to total assimilation in the interaction between the stressed mid-vowels and the final low vowel, with the Borriana Round vowel harmony within the word emphasizing the tendency towards coarticulation found out in the sequence /ˈɔ/+/a/ in all environments in Nules and across morphological boundaries and across words in Borriana.

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Two Types of Parasitic Assimilation

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Most phonological literature treats consonant harmony and parasitic vowel harmony as unrelated. This talk (i) shows that the two patterns are strikingly similar, and (ii) provides a unified analysis of parasitic assimilation as feature spreading. In particular, the solution lies in the interaction of alignment *and* agreement constraints.

Parasitic rounding harmony in Yowlumne (data from Newman 1944) depends on vowel height; harmony is attested only when the trigger and target are of the same height (1). Similarly, consonant/retroflex harmony in Kalasha (Arsenault & Kochetov to appear) is found only when the trigger and target are either both fricatives or both stops (2).

(1) Yowlumne rounding harmony

1^{ST} VOWEL IS ROUND			
HIGH	LOW		
muʈ-hu̠n ✓ ‘swear.AOR’	gop-hin × ‘take care.AOR’	HI	2^{ND} VOW
muʈ-taw × ‘swear.N.GER’	gop-to̠w ✓ ‘t.care.N.GER’	LO	

(2) Kalasha retroflex harmony

1^{ST} CORONAL IS RETROFL.			
FRICATIVE	STOP		
ʂuʂ̠ik ✓ ‘to dry’	ʈusu × ‘to peck’	FRIC	2^{ND} COR
ʂit × ‘tight-fitting’	t^{h}eʈ̠ ✓ ‘to scatter’	STOP	

These two patterns are much alike: in both, harmony depends on an additional similarity between triggers and targets. This similarity is overlooked by most analyses. A standard account of parasitic vowel harmony is feature spreading (Archangeli 1985; Steriade 1986; Archangeli & Suzuki 1997), while consonant harmony does not involve spreading, but instead feature agreement between consonants (Hansson 2001; Rose & Walker 2004). Here, I follow the intuition that two patterns are alike, and the differences between them stem from assimilation in general.

By and large, vowels make better targets than consonants (Howard 1972; Jensen 1974; Odden 1994; Steriade 1995). This asymmetry has to do with transparency. First, Vs often assimilate across Cs (V harmony), whereas the opposite pattern is restricted (e.g. no C harmony affects *all* Cs in a language). Second, a C trigger can target a V across another C (Salish), but no known language has the opposite pattern. In short, transparent Vs imply transparent Cs.

Such preference for V targets can be encoded in the general constraint that drives assimilation. Alignment constraints, for example, can target only Vs (Kirchner 1993). However, it is unclear whether transparent Vs violate classic alignment or not. Hyde (2008) proposed a modification of alignment that solves the problem. Here, I make use of Hyde's constraints to model assimilation. To illustrate, consider a constraint driving rounding harmony, *ω[rd,V] (3). This constraint is violated by triplets ⟨PWd, [rd], V⟩, when [rd] precedes a V within a word. Put differently, the constraint is violated by an unrounded V as long as it is preceded by some [rd] segment within a word. Transparent Vs meet this requirement and thus violate the constraint. Compared to classic alignment, the new constraints have an additional category—V in (3). The preference for V targets can be captured by ruling out the possibility of Cs as this third category. Hence, alignment prefers spreading to Vs or all segments, but not only to Cs.

(3) *ω[round,V]

*⟨PWd, [rd], V⟩ / PWd (dominating [rd] and V)

(4) AGREE[round,high]

A root node is associated with [rd] and [hi] iff all root nodes associated with [rd] are also associated with some [hi].

Yowlumne parasitic harmony rounds only a subset of Vs, which suggests that alignment should be complemented by another constraint. Standard agreement constraints (Lombardi 1999; Baković 2000) require adjacent segments of one type (e.g. obstruents) to be identical in terms of another feature (e.g. [voice]). Here, adjacency is already taken care of by alignment, hence it can be omitted in the definition of agreement. The remaining part requires that segments associated with some feature also agree in another feature. The constraint AGREE[rd,hi] (4), for example, is violated whenever [rd] is associated with both high and non-high segments.

In Yowlumne, AGREE[rd,hi] (4) outranks the alignment constraint (3) and the faithfulness constraint against adding association lines DEPLINK[round] (Itô et al. 1995; Myers 1997; Morén 1999/2001). When the trigger and target are of the same height as in (5), AGREE is never violated, and alignment prefers spreading. When the trigger and target are not of the same height as in (6), spreading violates AGREE (since not all segments linked to [rd] are [hi]).

(5) Alignment prefers harmony

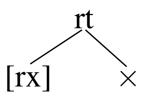
[r] / m u ṭ' - h i n / [h] [h]	AGREE [rd,hi]	*ω[rd,V]	DEPLK [rd]
a. [r] m u ṭ'h i n [h] [h]		*!	
b. ☞ [r] m u ṭ'h u n [h] [h]			*

(6) Agreement prefers similarity

[r] / m u ṭ' - t a w / [h] [l]	AGREE [rd,hi]	*ω[rd,V]	DEPLK [rd]
a. ☞ [r] m u ṭ't a w [h] [l]		*	
b. [r] m u ṭ't o w [h] [l]	*!		*

The situation is directly parallel in Kalasha, except that other constraints are involved. The alignment constraint *root[rx,×] prefers spreading of [retroflex] (used here for simplicity) to *all segments* within a root. Several AGREE constraints are required. Harmony is limited to triggers and targets that agree in features [continuant] (8), [sonorant], and [coronal] (omitted).

(7) *root[retroflex,×]
*⟨rt, [rx], ×⟩ /



(8) AGREE[retroflex,continuant]
An × is associated with [rx] and [cont] iff all ×s associated with [rx] are also associated with some [cont].

In both languages, agreement outranks alignment. A Kalasha input with two fricatives maps to candidate (9-b) with spreading to the target fricative. Note that transparent segments violate alignment. Spreading to all segments violates AGREE (9-c). An input with a fricative and stop maps to the faithful candidate (10-a), since any spreading in this case violates some AGREE. This is directly parallel to Yowlumne, with the difference being in the third category of alignment constraints (all ×s vs. vowels), and in the number of AGREE constraints.

(9) Alignment prefers harmony

[r] / ṣ usik /	AGREE [rx,cont]	AGREE [rx,son]	*rt[rx,×]	DEPLK[rx]
a. [r] ṣ usik			****!	
b. ☞ [r] ṣ uṣik			***	*
c. [r] ṣ uˇṣiˇkˇ	*!***	*!*		****

(10) Agreement prefers similarity

[r] / ṣ it /	AGREE [rx,cont]	AGREE [rx,son]	*rt[rx,×]	DEPLK[rx]
a. ☞ [r] ṣ it			**	
b. [r] ṣ iṭ	*!		*	*
c. [r] ṣ iˇṭ	*!*	*!		**

To sum up, I attribute the locality facts in regular assimilation to alignment constraints, which are never satisfied by spreading to consonant targets only. Crucially, alignment is agnostic about the triggers. Agreement constraints, on the other hand, are violated when triggers and targets are dissimilar. This correctly predicts that vowel harmony can be parasitic or not, whereas consonant harmony is always parasitic.

Spanish consonant clusters and the phonology of timing

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This paper offers a phonetically-driven phonological analysis of complex onsets in Spanish, an approach that makes strong typological predictions about the relationship between phonotactics and fine-grained timing patterns. The central proposal is that possibilities for the phonetic realization of various clusters within a language are constrained by independently-motivated syllable-level timing considerations. This solves a puzzle concerning the phonetic realization of obstruent-rhotic (OR) clusters in Spanish and makes a range of strong predictions about cross-linguistic patterns of cluster licensing and realization.

Spanish allows word-initial consonant clusters consisting of an obstruent followed by a liquid (e.g. /blaŋko/ 'white'), but not word-initial obstruent-obstruent (OO) clusters (e.g. */bdaŋko/). /r/, which is usually realized as a multiple-cycle apical trill word-initially, patterns as a liquid with regard to clusters (e.g. /braβo/ 'brave'). In a phonetically-driven model of phonology (e.g. [1], [2]), the availability of an initial obstruent in these sequences depends on the availability of perceptual cues to its presence, which are affected by the following segment. The acoustic realization of /r/ in such clusters, however, normally described as a tap, has as much in common acoustically with an obstruent like /d/ as with a liquid like /l/. The availability of OR clusters given the unavailability of phonetically similar OO clusters, then, is something of a puzzle in this approach.

Previous analyses ([3], [4]) have attempted to relate the licensing of OR clusters to the appearance of an excrescent vowel (the acoustic reflex of an open transition) in between the obstruent and tap (FIG. 1): the excresecent vowel generates cues to the presence of the initial obstruent, comparable to the cues available before a sonorant consonant like /l/. This line of analysis raises the question of why OO clusters cannot undergo the same repair. While we agree that perceptibility plays a direct role in this domain, we argue that both the availability of OR clusters and the unavailability of OO clusters are crucially dependent on higher-level timing factors related to *compression* effects.

Compression is the tendency for segments to be shorter in syllables that contain more of them ([5]). Syllables are subject to conflicting pressures, on the one hand to be realized with relatively short durations, and on the other hand to preserve the perceptibility of segments, which can involve lengthening those segments. In OR sequences, this conflict is resolved by simultaneously shortening the /r/ and the following vowel, while preserving the perceptibility of the vowel and the preceding obstruent. This involves producing the /r/ as a tap or short trill, 'displaced' into the following vowel, resulting in an excrescent vowel between the two consonants. Production data shows that the excrescent vowel tracks the formants of the following vowel, plausibly contributing to its perceptibility (FIG. 2). Vowels are shorter following an OR cluster than a singleton onset, consistent with the compression hypothesis.

In OO clusters, on the other hand, only a subset of the goals mentioned above can be achieved at once. For instance, shortening the vowel through extensive overlap with the preceding obstruent will decrease the vowel's perceptibility more than in the OR case, due to the longer closure associated with an obstruent. Trying to avoid this outcome by producing an excrescent vowel between the two obstruents will involve substantial lengthening of the syllable, penalized by timing constraints.

In this account, both the licensing and the realization of various clusters are affected by constraints on syllable duration. We predict, then, some cross-linguistic correspondence between the temporal properties of cluster realization and the variety of clusters licensed. In Spanish, for instance, only a temporally compressed realization of OR clusters is licensed; because OO clusters have no realization which is both temporally compressed and perceptually robust, they are not licensed. A language that allows less compressed realizations of OR clusters, on the other hand, is expected to allow a greater variety of other clusters, all else being equal. In the final section, we offer a preliminary characterization of how these predictions fare with regard to cluster licensing in Romance languages.

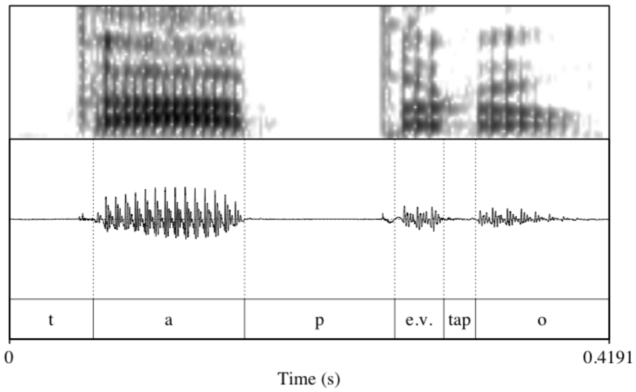

FIG. 1. *Utterance of nonce-word /tápro/ from a Venezuelan Spanish speaker. Visible in the waveform and spectrogram is an excrescent vowel (labeled 'e.v.') separating [p] and [ɾ].*

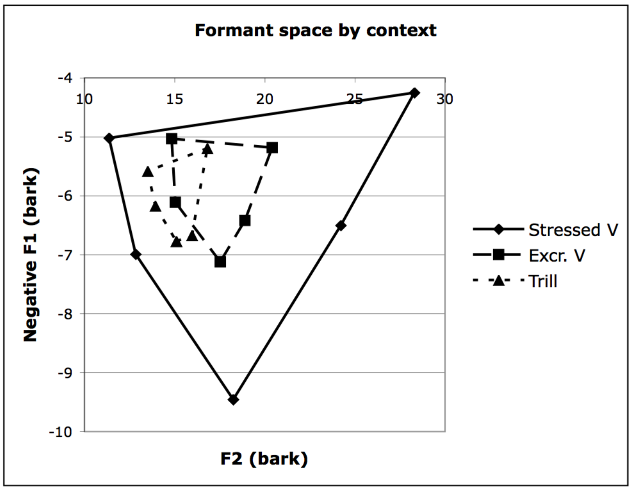

FIG. 2. *Formant space for one Venezuelan Spanish speaker internal to stressed vowels (largest space), excrescent vowels in stop-tap sequences (intermediate space), and the open phases of trilled /r/ (smallest space). Data points within each space are respective average values for {u, i, e, a, o}, clockwise from top left. Y-axis is inverted to preserve height orientation of vowel chart.*

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Secondary word stress in German – Experimental evidence from EEG studies and its theoretical implications

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What are possible positions of secondary stress in German words? Recent neurolinguistic studies (Domahs et al. 2008) using event-related potentials (ERPs) have shown that word stress in German depends on the internal prosodic structure, the feet. While these studies focused on main stress placement, it is still an open question what determines secondary stress assignment. Does secondary stress also depend on foot structure as is assumed e.g. by Alber (1997; 1998), Nespor & Vogel (1986), and Knaus & Domahs (2009), or is it determined by the rhythmical structure of the sentence and varies due to rhythmical preferences and the prosodic context as is claimed by Vennemann (1995) and Noel (2003)? Existing empirical evidence on secondary stress distribution in German is contradictory (Jessen 1999); for German loanwords, Moulton (1962) even negates the existence of secondary stress.

We conducted two neurolinguistic experiments that provide evidence for possible positions of secondary stress in German. In both studies, words were presented visually and then auditorily, embedded in a carrier sentence. The participant's task was to judge whether the word they heard was stressed correctly or not by pressing a yes-or-no-button. During the experiment electrophysiological responses (EEGs) were recorded and the EEG data in the crucial time windows were averaged to compute event related potentials (ERPs).

In our first experiment, stimuli were German words consisting of five syllables. The correct stimuli had main stress realized either on the antepenultimate, the penultimate or the final syllable. The incorrect conditions were produced by shifting stress to one of the other four syllables. Each word was presented with stress on each syllable as given in (1):

(1)
- *Kontrol'lierbarkeit – * 'Kontrollierbarkeit – *Kon'trollierbarkeit – *Kontrollier'barkeit – *Kontrollierbar'keit*
- *Enthusi'asmus – * 'Enthusiasmus – *En'thusiasmus – *Enthu'siasmus – *Enthusias'mus*
- *Anonymi'tät – * 'Anonymität – *A'nonymität – *Ano'nymität – *Anony'mität*

We found positivity effects for incorrect stress placement comparable to the studies of Domahs et al. (2008:18), where positivities are said to reflect how easy prosodic mismatches were detectable for the participants. The observed positivities differ in strength. If stress is shifted to a foot head, positivities are less pronounced than in shifts to a non-head position. Among the shifts to head positions the word initial syllable evokes the least pronounced effect.

In the second experiment words with five syllables were combined with trisyllabic words forming compounds with the longer part as final constituent. The trisyllabic first parts were always stressed correctly either on the penultimate or the final syllable. Compound main stress invariably fell on this first constituent. Only in the pentasyllabic second part stress violations occurred. In the correct conditions main stress was realized on the penultimate or the final syllable, in the incorrect ones stress was shifted to the initial or the second syllable of the final constituent. Accordingly, in some of the stimuli a stress clash occurred (when first constituent was stressed finally and the second had incorrect initial stress). Examples in (2) illustrate the stimulus design:

(2)
- *Eur'opa-Enthusi'asmus – *Eur'opa-'Enthusiasmus – *Eu'ropa-En'thusiasmus*
- *Parla'ments-Enthusi'asmus – *Parla'ments-'Enthusiasmus – *Parla'ments-En'thusiasmus*

- *A'roma-Sensibili'tät – *A'roma-'Sensibilität – *A'roma-Sen'sibilität*
- *Aggres'sions-Sensibili'tät – *Aggres'sions-'Sensibilität – *Aggres'sions-Sen'sibilität*

This structural set-up of the stimuli allowed us – in addition to a replication of the results of the first experiment – to test whether stress in an immediate prosodic context (the first constituent of a compound) influences the participants' reactions to stress shifts in the second constituent.

Again, we found positivity effects in conditions where stress was incorrect. When stress was shifted within the second constituent from the penultimate syllable to the first or the second syllable positivity effects occurred, but it was less pronounced when stress was shifted to the initial syllable (a foot head) than when stress was shifted to the second syllable (a non-head). In conditions where stress was shifted from the final syllable, a significant positivity effect occurred only for the shift to the second syllable, while the shift to the initial syllable did not result in any significant effect. Crucially, the immediate prosodic context did not influence stress processing at all. Results did not differ depending on the stress pattern of the first constituent. Stress clashes induced by final stress in the first part and initial stress in the second part of the compound did not make the second syllable more preferable as a target position for stress shifts. The preference for the initial syllable persisted.

The experimental results show that stress placement clearly depends on foot structure in German. The first experiment shows that stress processing in German prefers the head of a trochaic foot. If secondary stress is realized, then it is on one of these prosodically strong positions, preferably on the initial syllable. This finding corroborates the analyses by Alber (1997; 1998) claiming secondary stresses to be aligned with the left edge of words. The results of the second experiment confirm these findings and demonstrate that the structural preferences remain stable when the prosodic context is varied, even if this leads to otherwise dispreferred forms (i.e., stress clashes). Word stress within compounds is processed independently within each word.

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Against predictable exceptions: name morphology in Dutch

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The issue. In the formal analysis of Dutch stress, place names and proper names are often taken into consideration to test phonological generalizations for monomorphemic words, largely based on data from the native vocabulary and from loanwords. A notably high number of names form exceptions to even the strongest generalizations we find in the rest of the vocabulary – they are usually assumed to be stored lexically (e.g. Van der Hulst 1984, Trommelen & Zonneveld 1989, Kager 1989, Booij 1995, Van Oostendorp to appear).

We argue that many of these seeming lexical exceptions are not in conflict with the synchronic grammar: they constitute morphologically complex forms that follow similar, predictable, and productive patterns. We show the regularity of these 'predictable exceptions' on the basis of data from relevant databases and present experimental data from reading tasks / stress-assignment tests (to be conducted) with fantasy names that are structurally similar to the proposed synchronic patterns. We expect that the results will provide additional evidence that these patterns are indeed productive.

By attributing these data to a synchronic interaction of phonology and morphology, our paper contributes to the following debates in phonology: i. the role of *representation vs. computation*, and ii. the role of *synchrony vs. diachrony*. With respect to i., we discuss why a representational solution may be preferable over assuming e.g. a co-phonology for names in Dutch. With respect to ii., we argue that there is no need to refer to a model of lexical storage plus analogy to account for the facts.

Some problematic data. Strong generalizations for Dutch stress seem weakened when we take names into account. We provide and discuss a variety of relevant data; a small selection of examples are mentioned below:

a) The Three-Syllable Window (3σ): despite being an almost exceptionless generalization for Dutch, some toponyms do not follow the expected stress pattern as they have preantepenultimate stress (see Kager 1989, Booij 1995, Van Oostendorp to appear, among others). Consider the examples in (1):

(1) **wá.**ge.nin.gen, **schéé**.ve.nin.gen, **á**.me.ron.gen, **hóé.**ve.la.ken

b) Schwa-syllables are in the weak position of a foot (weak schwa): this principle of Dutch phonology is apparently disobeyed by some Dutch toponyms (see e.g. Van der Hulst 1984, Kager 1989, Van Oostendorp 2000, our data):

(2) (**bún**.scho)tən, (**cóé**.vor)dən, (**níj**.me)gən, (**róér**.da)lən, (**gró**.nin)gən

c) Superheavy final syllables (SHF): SHF attract stress in Dutch. However, this generalization seems to hold much less in names, which regularly violate the principle: one of many examples are proper names ending in –ald. Although the SHF should be stress-attracting, these names never have final stress, as for instance:

(3) **é**.wald, **dó**.nald, **ós**.wald (mentioned in Van der Hulst 1984 as a lexical exception)

Similar cases can also be found in toponyms, e.g. those ending in the SHF –drecht, which never receive final stress (Schrijnen 1916):

(4) **dór.**drecht, **slíé.**drecht, **pá**.pen.drecht, **dúí**.ven.drecht

The solution. We can understand the regularity / productivity of such patterns if we regard them as morphologically complex rather than as lexical exceptions. For the abovementioned examples, this works as follows:

Ad a): in these forms, *–en* is geographical suffix, and it is stress-neutral (as many other Dutch suffixes, see e.g. Booij 1995). It follows that the toponyms in (1) do not violate 3σ. The base forms also combine with other suffixes, as e.g. in attributive function (-er, -s):

(5)	*Place name (-en)*	*Attributive (-er)*	*Attributive (-s)*
	wá.ge.nin.gen	**wá**.ge.nin.ger	**wá.**ge.nings
	sché.ve.nin.gen	**sché**.ve.nin.ger	**sché**.ve.nings
	á.me.ron.gen	**á**.me.ron.ger	**á**.me.rongs
	hóé.ve.la.ken	**hóé.**ve.la.ker	**hóé.**ve.laaks

Note that if these forms were really lexical exceptions, then many more forms would incur violations of 3σ, as for instance **ér**.me.lo.er (derived from **ér**.me.lo), **hén**.ge.lo.er (from **hén**.ge.lo), **híl**.le.gom.mer (from **híl**.le.gom), etc. These additional facts support a morphological analysis.

Ad b): Identifying -en as a stress-neutral suffix also accounts for the facts in b): 'weak schwa' does not apply to the examples in (2); they are morphologically complex, their base forms can be combined with the same suffixes as the forms in (5).

Ad c): instead of regarding the examples in (3) and (4) as lexical exceptions, we can analyze them morphologically: '–ald' (suffix) as well as '–drecht' (second part of a compound) are additions to base forms. Under this assumption, the predictability of the patterns follows.

Alternative analyses. Our account suggests that Dutch names are morphologically more complex than often assumed in the literature. It integrates predictable patterns into the grammar without making reference to a co-phonology for names or to analogical relations between lexically stored items:

Lexicon plus analogy (e.g. Blevins 2004, Goldberg 2006): there is no need to attribute the attested patterns to analogy, as their productivity can readily be explained in a formal analysis.

Co-phonology (e.g. Orgun 1996, Inkelas & Zoll 2005): we argue that there is no possible constraint ranking that could account for the data without reference to morphology. To account for the examples of stress-avoiding SHF in (3) and (4), a separate name phonology would need to have a constraint ranking that forbids final stress throughout. Yet this would make wrong predictions for other data: productive final stress can be found in many cases, as in place names ending in *–dám* (am.ster.**dám**, vo.len.**dám**, etc.), although these syllables are not superheavy. This would be a fatal problem for a purely phonological analysis: by implication, final heavy syllables can never be stronger stress attractors than SHF under any constraint ranking. Therefore, some forms would have to be regarded as morphologically complex under both approaches. Thus, there seems no gain in assuming a co-phonology.

Summary. Our analysis shows how representational approaches may help understand seemingly exceptional yet synchronically productive patterns. While we acknowledge that our approach leads to an increase of bound morphemes / cranberry morphemes in the lexicon, we believe that the observable regularity of the data justifies and even supports this assumption.

Native language biases of Khalkha Mongolian speakers in the acquisition of non-adjacent phonological dependencies

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This paper investigates how native language phonology influences participants' acquisition of non-adjacent phonological dependencies in an artificial grammar learning task (AGL). Current AGL literature on non-adjacent phonological dependencies has shown that participants acquire these dependencies only with difficulty (e.g., Gómez 2002; Newport & Aslin 2004; Bonatti, Peña, Nespor & Mehler 2005; Onnis, Monaghan, Christiansen, & Chater 2004). However, all these studies were conducted on native English and French speakers, provoking some question over whether participants' difficulty in acquiring non-adjacent phonological dependencies is due to native language biases. The current paper addresses this question by examining native speakers of Khalkha Mongolian, a language which displays precisely such a dependency: ATR vowel harmony. The results of three experiments indicate that participants successfully acquired non-adjacent vocalic dependencies, evidenced through a significant preference of 'words' vs. 'part-words,' though native English and French subjects displayed difficulties doing so (e.g. Newport & Aslin 2004; Gómez 2002; Bonatti et al. 2005; Onnis et al. 2003, 2004). Importantly, this work is part of the first psycholinguistic study conducted on Khalkha Mongolian.

All 3 experiments consisted of a 14 minute training phase followed by a forced choice testing phase. Training stimuli for all 3 experiments was a continuous speech stream constructed from concatenated CV syllables, where specific triplets of non-adjacent vowels exhibited dependency, or high transitional probability, while all other transitional probabilities between both adjacent and non-adjacent segments were low. Other cues indicating 'word' boundaries such as consonant distribution, pitch, and co-articulation were controlled. Participants' acquisition success was tested through a forced choice task between 'words' (CVCVCV items with high transitional probability) and 'partwords' (CVCVCV items which exhibited low transitional probability) taken from the training speech stream. Twenty adult native Khalkha speakers participated in each experiment.

Experiment 1 was a replication of Bonatti et al. (2005) and used 3 non-harmonic vowel triplets as non-adjacent dependencies. Experiment 1 results revealed a significant preference for words over part-words ($p<0.005$), indicating that participants successfully acquired the three non-adjacent phonological dependencies, in contrast to the results of Bonatti et al. (2005) where participants failed to acquire non-adjacent vocalic dependencies.

Experiments 2 and 3 sought to investigate more closely the role of native language phonology in artificial grammar learning experiments. Therefore, Experiment 2 stimuli were 4 [ATR] harmonic vowel triplets, while Experiment 3 stimuli were 4 non-harmonic vowel triplets. The results of both experiments indicated a significant preference for words over part-words ($p<0.005$). Furthermore, a significant difference was found in preference rates between the two experiments, indicating that harmonic status of the training stimuli had a significant effect on participants' acquisition success ($p<0.005$).

Collectively, Khalkha speakers' ability to acquire non-adjacent vocalic dependencies in all three experiments indicates that native language phonology plays an important role influencing the aspects of language toward which speakers attend. This research increases our understanding of the role of phonotactics in perception, and has implications for continued inquiries in production and perception, including formal theories of language as well as speech segmentation, lexical access and lexical organization.

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Glide – high vowel alternations at the interface of syntax and phonology

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Berber languages present a wealth of intricate phonological alternations involving glides and high vowels, some of which still resist standard phonological analyses. Glides typically appear in the immediate vicinity of a vowel, in complementary distribution with the corresponding high vowels. Based on this kind of observations, standard theories analyse glides and high vowels as phonetic reflexes of the same underlying segments. The examples in (1) illustrate the situation in Tashlhiyt Berber:

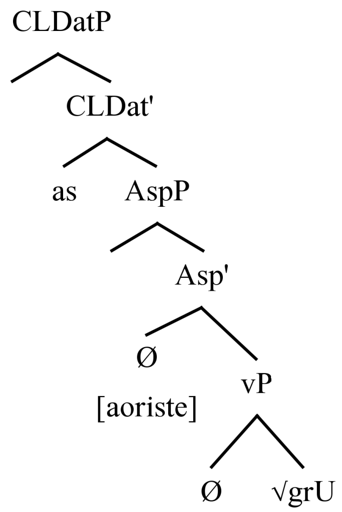
(1)

gru 'pick up'	agraw 'assembly'
bri 'crush, pound'	abraj 'crushed seeds'

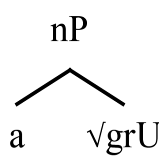
The problem arises with the corresponding dative forms *grujas* 'pick to him' and *brijas* 'crush seeds to him'. Followed by a vowel-initial morpheme –as, U and I should normally surface as glides, leading to **grwas* and **brjas*. Faced with similar forms in Tamazight Berber Guerssel (1986: 3) posits "a phonemic distinction between glides and high vowels".

The key to understanding this paradox lies, we argue, in the morpho-syntactic structure of dative formations. In line with recent works at the syntax – phonology interface (Marvin 2002, Marantz 2007, Pigott and Newell 2006, Samuels 2010), we argue that the behaviour of I and U in the forms just discussed is the result of the application of spell-out and phase impenetrability condition (Chomsky 2001) at different levels in the syntactic structure. In particular, we show that vP corresponds to a phase where U and I are spelled-out as high vowels before the enclitic –as is added. The resulting hiatus is then resolved by means of *j* epenthesis, leading to *grujas* and *brijas*. In *agraw* and *abraj*, U and I surface as glides since they belong to the same phase (nP) as the neighbouring a. The forms represented in (2) illustrate the proposal:

(2) a. *grujas* "pick to him"



b. *agraw* 'assembly'



Spell-out-as-you-merge and Phase Impenetrability thus allow explaining the paradoxical behaviour of I and U in Tashlhiyt Berber (see also Pigott and Newell 2006 about Ojibwa). The question that arises then is the following: under the assumption that phonology is sensitive to external morph-syntactic information, what kind of devices allows direct inter-modular communication? Do morpho-syntactic phases leave any phonological traces?

Following Scheer (2011), we will assume that empty CV units, purely phonological objects (Lowenstamm 1996, 1999), carry morpho-syntactic information into phonology. They mark phase boundaries. How does phonology use these empty CVs is an issue we will discuss.

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Seeking for the default in a lexical stress system

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Take a language like Russian, where stress is generally characterized as 'free', i.e. it is not fixed to a particular syllable or a morphological part of a word and is independent of the phonological form of a word, what is the default stress pattern and how does one look for it? Despite its truly lexical nature, researchers have often searched for regularities in the realization of word stress in Russian and argued for the relevance of metrical analyses. This enterprise, however, gave way to a set of contradictory findings: van der Hulst (1999) and Hayes (1995) classify Russian as an unbounded lexical accent system, Halle & Vergnaud (1987), Melvold (1990), Crosswhite (2000) argue for an iambic foot, whereas Revithiadou (1999) claims that Russian has a trochaic grouping of syllables. The primary evidence for the foot in these studies came from the so-called default position of stress that arises when there is no lexically specified accent in a word. However, the default positions proposed for Russian are also paradoxical: word-initial (Melvold 1990), stem-final (Crosswhite, Alderete, Beasley and Markman 2003), and post-stem (Alderete 2001).

In this talk, we will argue that the only reliable way to inspect speakers' underlying stress pattern is through their realization of novel words that crucially lack morphological information. Accordingly, we will report a series of production studies that meticulously examined the default stress pattern in Russian using a wide array of structures. In the first two studies, we used a group of indeclinable words: (i) novel place names (the preliminary results of which were presented at OCP-8), and extended our findings to (ii) acronyms, another word class that readily escapes the confounding effects of declination. Our findings consistently merge on the following default pattern: final stress in consonant-final words, penultimate stress in vowel-final words. Accordingly, we will argue that the default stress pattern is best characterized by a syllabic trochee built at the right word-edge. Assuming that that all Russian words (including consonant-final ones) underlyingly end in a vowel – an observation which is diachronically well-founded (Bethin 1998) – our analysis provides a unified account of default stress in both consonant- and vowel-final words. We also examined the effect of various factors on stress placement such as vowel quality in the last two syllables (back/front), type of the penultimate syllable (closed/open) and word structure (two-/three-syllable words). The table below demonstrates, however, that the type of final segment is the strongest predictor and accounts for 52% of the variation of the data (Nagelkerke's R^2=.524). The other predictors altogether explain only 0.9% of the variation of the data so that the fit of the model is rather poor (Nagelkerke's R^2=.009).

Predictor	Wald	Significance	Exp(B)
Final segment	1920.037	p<.001	33.357
N of syllables	52.930	p<.001	1.892
Syllable type	1.334	p>.05	1.104
Vowel quality			
front-front	14.491	p<.05	
back-back	10.797	p=.001	.697
back-front	.062	p>.05	.973
front-back	.066	p>.05	.973

Our third study, which is currently underway, examines rhythmic alternations, which have so far been poorly studied in Russian. The primary aim here is to see whether an underlying metrical structure, presumably the trochee, plays a role in secondary stress assignment as well as vowel reduction patterns in Russian. In particular, we studied prominence relations in novel compounds and vowel reduction patterns in simple non-words in rapid speech. The base component of a compound was a real word and the first component was a novel word of different syllabic structures (e.g., *tolomorezka* “tolomocutter”) which enabled us to control for stress assignment in words of different length.

In light of our findings, we will offer a full-fledged account of the much disputed default stress pattern and the type of metrical structure in Russian that is not only psycholinguistically valid but also accords well with diachronic developments.

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(Bi)Directionality in Substitution Patterns in Aphasic Language

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We present data of Dutch aphasic patients which indicate that segmental substitutions in aphasic language are not random but do show sensitivity to markedness principles (De Lacy 2006).

Issue. In his influential work *Kindersprache, Aphasie und allgemeine Lautgesetze* (1941), Roman Jakobson claims that language attrition in aphasia not only mirrors child language acquisition but that both processes obey general markedness principles. He claims that marked phonological contrasts are lost first in aphasic language, and that unmarked contrasts are preserved longer.

For a group of Dutch aphasic speakers it has been shown (Linke 2011) that the individual segment inventories did not show any segmental gaps, indicating that the claimed loss of phonological contrast might be too strong. A more detailed investigation in the substitution patterns revealed the patients' sensitivity to feature-based phonological distance. Since this finding indicates a non-random substitution behaviour, it is interesting to examine if markedness principles can be traced in the observed substitution patterns.

Data. Recordings of standardized clinical tests (e.g. Akense Afasietest 1992, PALPA 1995) of eight native Dutch aphasic speakers (all diagnosed with a phonological impairment, but no impairment of articulatory or auditory organs) were provided by Rijndam Revalidation Center in Rotterdam, The Netherlands. The analysis is restricted to recordings of non-spontaneous speech collected during naming, repetition and reading task therapy sessions. A database of aphasic production data was created that could be searched for faithful and unfaithful realizations on a segmental basis. Typical examples of segment substitutions are the following:

/tɑs/	'bag'	→	[bɑs]	/rɔk/	'skirt'	→	[rɑk]
/tɑk/	'twig'	→	[dɑk]	/mɛs/	'knife'	→	[mʏs]
/stɛr/	'star'	→	[stɛl]	/bur/	'farmer'	→	[byr]

Methods. For each patient, all segment substitutions were collected in substitution/confusion matrices, which were subsequently analyzed for directionality in the substitution patterns. This was done separately for onset, nucleus and coda positions in stressed and unstressed syllables of monosyllabic and polysyllabic words. The present analysis is restricted to non-nucleus substitutions.

The directionality analysis employs the property of any square matrix to be uniquely decomposable into a symmetric and an antisymmetric matrix. By weighing the antisymmetric and the symmetric components, a normalized index was developed that indicates the directionality of a substitution. As a result, for any pair of segments (k, l), where k is the target segment and l the actually produced segment, a number $\alpha \in [-1, 1]$ was calculated that represents the amount of k substituted by l compared to the amount of l substituted by k. If the substitutions are balanced, the number α is equal to 0. Based on the indices per pair, the directional substitution behaviour of whole natural classes was examined.

Results. Overall, the directional substitution patterns show large inter-speaker variability. However, some tendencies can be detected. In general, coronals seem to be attractors, i.e. they are more often a product of a substitution. This is in line with markedness principles. Furthermore, dorsals seem to be preferred over labials. It still has to be investigated if this is a language-specific characteristic.

In onset positions of monosyllabic words, sonorants are more often avoided, whereas obstruents represent attractors. This pattern is much less strong in polysyllabic words. In all coda positions, approximants represent attractors.

No directionality preference could be found for voiced or voiceless segments.

Conclusion. The pattern of non-random segment substitutions indicated that phonologically impaired aphasic speakers are guided by sub-segmental structure in their language output. Furthermore, the directionality patterns of their substitutions show characteristics based on markedness principles.

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Lexical and phonological variation in Russian prepositions

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Introduction. The Russian prepositions [s], [k] and [v] have two forms, a monoconsonantal (C) form and a consonant + vowel (CV) form. The C form occurs before words that start with a single consonant or with a stop-initial cluster ([s máməj] 'with mother', [s prikázom] 'with the order'). The CV form sometimes occurs before other cluster-initial words ([sa/*s mnoj] 'with me'), but the variation is not well understood. We present the results of two corpus studies and a nonce word experiment exploring the factors that determine this variation. We confirm and refine two previous observations: first, that the CV form is used to prevent violations of the Sonority Sequencing Principle (Selkirk 1984, Clements 1990); and second, that it is used to break up sequences that violate the Obligatory Contour Principle (McCarthy 1986), that is, cases in which the preposition is too similar to the following consonants, thus [va vrémʲə] 'in time', not [*v vrémʲə], and [sə stərikóm] 'with an old man', not [*s stərikóm] (Steriopolo 2007, Gribanova 2009). In addition, we report two new phonological findings: stress-initial words favor the CV form, as do words that start with [v + strident] clusters, suggesting that [v] is transparent to the OCP. Finally, our systematic corpus investigation enables us to uncover a large set of previously unnoticed lexical exceptions to the phonological rules.

The prepositions are etymologically related to prefixes, which also have alternating vowels that have been analyzed as *yers* (Lightner 1965 et seq.): the vowel surfaces when followed by a deleted vowel but not otherwise: /so-gor-etʲ/→ [sa-gr-étʲ] 'to burn up' but /so-gib-atʲ/ → [s-gib-atʲ] 'to bend' (Matushansky 2002). We follow Steriopolo (2007), who shows that the conditioning environment for prepositions does not depend on deletion in the following syllable: witness [s psom] 'with the dog', not [sa psom], cf. [pʲos] 'dog'. Rather, the conditioning is lexical and phonological, and we investigate the various factors in three studies.

Corpus study 1. We extracted all of the cluster-initial words in the Russian lexicon from Usachev's (2004) list of over 94,000 paradigms. We then counted how often the words occurred after C and CV preposition forms in the Russian National Corpus (http://www.ruscorpora.ru). A subset of 901 of the cluster-initial words had a sufficient number of tokens for statistical analysis. The results confirmed the OCP effect for [v] and [s]. We identified many lexical exceptions to the phonological regularities, in particular in historically conservative contexts: frequent monosyllabic words, ecclesiastical words, and words that form part of idioms. Strikingly, there are cases of variation between different morphological forms of the same word: [sa/*s dnʲa] 'from the day' versus [s/*sa dnʲom] 'with the day'.

Corpus study 2. We expanded our study to the much larger corpus accessible through Yandex, the Russian language search engine. Search engine results pose significant methodological challenges: they are considerably noisier than hand-constructed corpora, and the result counts are not as reliable. Despite these concerns, we identified two previously unnoticed phonological generalizations through the use of robust statistics. First, stress-initial words favor the CV form more than non-initial stress words. Second, word-initial clusters of the form [v + strident] favor the [sa/sə] form (e.g., [sa vz...] is preferred to [s vz...]), suggesting that [v] is transparent to the OCP.

Nonce word experiment. Finally, we corroborated our findings in a forced choice experiment. We selected 11 clusters (vz, vs, vd, vn, ms, rd, rn, xr, xs, ʃr, ʃt) and constructed 8 nonce words for each cluster: 4 of them were stress initial (e.g. [xsídom]) and 4 stress final (e.g. [xsidóm]). We played audio files of the C an CV forms, e.g., [s xsidóm] and [sə xsidóm], and asked people to choose between them. The experiment was conducted on the web and included 86 Russian speakers. (We did not replicate Steriopolo's (2007) finding that older speakers prefer CV forms, but that study included just 4 speakers.)

Our experiment confirmed the effects of the OCP and and the Sonority Sequencing Principle found in the corpus studies, and it showed that these constraints interact gradiently: the sequence [s + sC] is less acceptable than [s + ʃC], even though both are dispreferred by the OCP (Pajak and Bakovic 2010). Even within OCP-violating clusters, we see sonority effects: [s + ʃt], with falling sonority in the word-initial cluster, is less acceptable than [s + ʃr], with rising sonority.

The CV form [sa/sə] is favored before [v + strident] clusters such as [vz]. The dispreference for [s + vz] is larger than would be predicted by sonority sequencing alone: clusters of [v] with non-strident obstruents, such as [s + vd] and [s + vx], were preferred to [s + vz]. This suggests that [v] is transparent to the OCP, providing new and independent support for the analysis of the Russian [v] as an underlying glide [w], which so far has been based primarily on its transparency to voicing assimilation (Hayes 1984, Kiparsky 1985, Padgett 2002). We also found an effect of sonority distance for [v] clusters: [s + vn] is more acceptable than [s + vd] (steeply falling sonority) which in turn is more acceptable than [s + vz] (falling sonority and an OCP violation across the transparent [v]).

The experiment confirmed the effect of stress found in Corpus Study 2: stress-initial words are more likely to favor the CV form. We analyze the effect as perceptual: the vowel of the CV form is reduced to [ə] when it is more than one syllable away from the stress, e.g., [sə stərikóm], not [sa stərikóm]; this makes the difference between the C and the CV form less perceptible.

Discussion. Our nonce word experiment showed that the realization of prepositions is controlled by a productive phonological grammar, but we also found considerable variation in Russian usage. For example, the literature reports that [mn]-initial words prefer CV prepositions (Gribanova 2009), which is puzzling since the flat sonority cluster satisfies the Russian Sonority Sequencing threshold. The corpus studies show that this is an artifact of a handful of prominent lexical exceptions ([sa/*s mnoj] 'with me', [sa/*s mnogimi] 'with many'). When these exceptions are removed, the preferred form is the C form [s], as expected (e.g. [?sa/s mnenijem] 'with the opinion'). This has a more general implication: the sensitivity of prepositional phonology to lexical exceptions casts doubt on the division between lexical and postlexical rules that are assumed in Lexical Phonology and Stratal OT (Kiparsky 1985, Kiparsky 2000, Rubach 2008, Gribanova 2009; cf. Coetzee and Pater 2009).

Our large-scale corpus investigation enabled us to identify previously unnoticed phonological patterns on the one hand, and to map out the extent and nature of lexical exceptions to those rules on the other hand. Search engine results, while noisy, yielded patterns that were then replicated in a nonce word experiment. The prevalence of lexical exceptions points to the dangers of basing an analysis on a small set of cherry-picked examples, and calls into question the validity of the [s/sa] alternation as a paradigmatic example of the distinction between lexical and postlexical rules.

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INTERACTION OF INTONATION AND TONE IN BASAA QUESTIONS

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While it is generally agreed upon that intonational functions can be conveyed even in tone languages, systematic experimental studies on the relationship between tones and intonation are still rare. Some studies reported that intonation might be responsible for the widening of overall pitch range (Xu 1999), boundary tone insertion or superimposition (Hyman 1990, Rialland & Embanga Aborobongui 2011) or phrase-internal demarcation through downstep (Zerbian, 2011). In a work on a Bantu language (Shekgalagari), Hyman and Monaka (2008: 269) suggested that tonal languages allow for three strategies of tone/intonation cohabitation, i.e. accommodation (no interaction between tone and intonational tones), submission (lexical tones are overridden by intonational tones) and avoidance (intonation is confined to express paralinguistic functions). Intonational functions can be expressed by other cues than pitch, such as creaky and breathy voice, and devoicing (Hyman and Monaka , 2008) and pre-boundary lengthening (Zerbian and Barnard, 2008). This study reports on an acoustic experiment investigating the relation between intonation and syllable-level tones in Bàsàa, a Bantu language spoken in Cameroon by 285.000 people. In particular, we focused on yes/no and wh- questions. Both question types are marked by morphosyntactic cues. Yes-No questions (1b) are characterized by the adjunction of an affix vowel in sentence final position. This vowel, like other affixes in this language, is underlying toneless and acquires a default Low tone (Makasso 2011). Wh-questions are signaled by other morphological markers (such as kíí), which might occur at different locations within the sentence, i.e., in in-situ position at the sentence final (2a), in ex-situ position (2b), in in-situ position within a prosodic group (2c) and in in-situ position at the edge of a prosodic group (2d). The phonological structure and syntactic position of the wh-marker are discussed in Hamlaoui & Makasso (2011b).

1.

a. mààŋgɛ́ à ŋ́!gwés líkúβé
child Agr pr-like banana
« the child likes banana »

b. mààŋgɛ́ à ŋ́!gwés líkúβé-è̲
child Agr pr-like banana
« Does the child like banana ?»

2.

a. mààŋgɛ́ à ŋ́!gwés **kíí**
child Agr pr-like what
« what does the child like ? »

b. **kíí** mààŋgɛ́ à ŋ́!gwês
what child Agr pr-like
« what does the child like ? »

c. mààŋgɛ́ à ŋ́!gwés **kí** ʤɛ́
child Agr pr-like what manger
« what does the child want to eat? »

d. mààŋgɛ́ à ŋ́!gwés ʤɛ́ **kíí** nì lìwándá ʤéé
child Agr pr-like manger what with friend poss
« what does the child want to eat with his friend? »

To verify the existence of additional intonational markers in Basaa, a corpus was collected, in which six native speakers (two females and four males; mean 24 years old) had to read sentences (1, 2) four times. The acoustic analysis was performed by means of Praat (Boersma and Weeninck; 2001)

Preliminary results suggest that yes/no questions are signaled by creaky phonation at the end of the sentence, which cause the deletion of the L tone on the affix vowel. Moreover, the wh- marker in ex-situ context seems to have higher f0 values than in in-situ positions as seen in figure 1 below.

This supports the hypothesis that in Basaa tones undergo intonation submission.

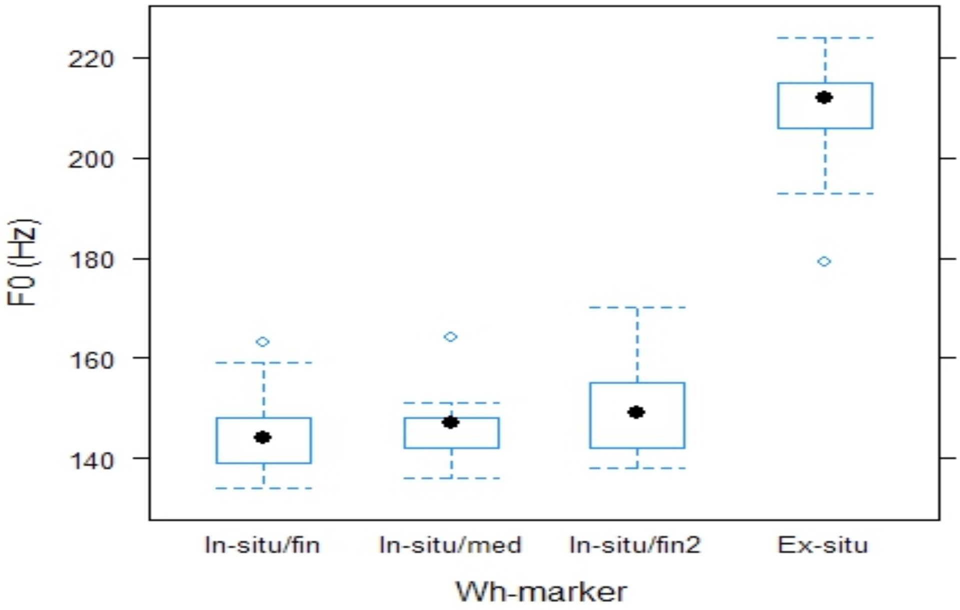

Fig 1: *Boxplots of F0 values of the wh-marker syllable for one speaker.*
Results are split across wh-marker location within the sentence (in-situ/fin: at the end of the sentence; in-situ/medial: within the sentence; in-situ/fin2: at the edge of a prosodic group; ex-situ: at the beginning of the sentence)

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Some like it twice: cycles, yers, velars, and the Polish –*ek*

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This paper analyses the Polish diminutive suffix –*ek* as having two allomorphs: the unmarked –*ek,* attaching to stems terminating in labials and coronals on one cycle, and the velar –*ek,* which is hereby claimed to be composed of two morphs, attached to the stem on consecutive cycles.

Polish morphophonology exhibits two well-known phenomena: palatalisation and vowel~zero alternations. Almost unremarkable in the case of labials, the native lexical palatalisation pattern is quite conspicuous in the case of coronals and velars. In segmental terms, the consonants affected can be illustrated in (1) (labials and coronals) and (2) (velars), following Gussmann's (2007: 128) *palatalization replacement* patterns ("PR"). The upper rows show plain consonants, the lower rows show their palatalised counterparts.
Vowel~zero alternations are discussed at length in Rubach (1986), Scheer (2004), or Gussmann (2007), to list just a few references. In short, a vowel that alternates with zero—historically such a vowel is called a *yer*—is phonetically present if not muted by the nucleus of the following CV unit (i.e. syllable); should that CV unit contain a true vowel, the yer is absent phonetically, as shown in (3).

The interesting case appears when a yer happens to trigger palatalisation. As shown in (4), the co-occurrence of the two processes happens in the lexical domain, and appears to apply without exception. While the examples are far from being numerous, the generalisation, largely unstressed in the literature, is the following: a palatalising yer will only palatalise if actually present in the output. Thus, if a palatalising yer is not present phonetically, the potential target of palatalisation appears in the unpalatalised form.

The generalisation appears to have one important exception: the diminutive –*ek* [ɛk]. As shown in (5), the diminutive has very clear phonological properties: it has a non-palatalising yer. When used with stems terminating in velars, however, the –*ek* appears to trigger palatalisation (so-called *First Velar*). Moreover, the palatalisation of the pre-diminutive stem-final consonant is permanent, i.e. one of the lower counterparts listed in (2) appears throughout the paradigm, irrespectively of the yer actually appearing on the surface or not—see (6b)—in defiance of the pattern demonstrated in (4).

This paper will demonstrate that it is analytically feasible to treat the velar –*ek* allomorph as being composed of a syntactic tree hosting two phonological exponents that are concatenated with the stem on consecutive cycles. The first exponent to be concatenated only contains a single palatalising stable (non-yer) vowel, presumably //i//, which causes First Velar through the spreading of its palatality feature, the element {I} onto the velar, causing the consonant to share the element {I} with the vowel as a common head (as advocated in Michalski 2009); in the binary world, this equals regressive spreading of [–back]. Thus, representationally, the velar is now marked for palatality, and can be interpreted phonetically as distinct from an unmarked/unpalatalised velar. The second exponent of the two-cycle –*ek* is identical to the unmarked –*ek*; it has a non-palatalising //ɛ// yer. On the relevant cycle, the derived environment is evaluated for possible vowel hiatus, which would indeed appear. However, at this stage, a very well-known constraint found in Slavic languages comes into play. Namely, the left-hand vowel is deleted, as first demonstrated for Russian in Jakobson (1948). When deleted, the palatalising part of the velar –*ek* leaves its element {I} on the consonant it previously palatalised; there is no general constraint in Polish on palatalised consonants present when no vowel follows. Once the original vowel is deleted, the yer of the morph introduced on the latter cycle takes its place. Not being a palatalising vowel, it cannot influence the stem-final consonant; non-palatalising vowels do not depalatalise velars in Polish. In the end, the original velar is phonetically interpreted as a coronal—see the lower row in (2)—while the remaining part of the diminutive now behaves like any other yer-hosting site. The present proposal uses mechanisms that are independently attested for Polish (yers and vowel deletion), without introducing ad hoc segments or postulating any paraphonological activity in the velars (i.e. being palatalised with non-palatalising vowels). The only costs is the acceptance of an abstract analysis instead of non-workable surface-based generalisations.

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(1) PR1 (Gussmann 2007: 128)

p	b	f	v	m	r	w	n	t	d	s	z
|	|	|	|	|	|	|	|	|	|	|	|
pʲ	bʲ	fʲ	vʲ	mʲ	ʒ	l	ɲ	tɕ	dʑ	ɕ	ʑ

(2) PR5 (Gussmann 2007: 128)

k	g	zg	x
|	|	|	|
tʃ	ʒ	ʒdʒ	ʃ

(3) *pies–ϕ* [pʲ(j)ɛs] ‘dog’ *ps–a* [psa] ‘(id. gen.sg.)’

(4)
(4a) *marzec–ϕ* [maʒɛts] ‘March’ *marc–a* [martsa] ‘(id. gen.sg.)’
(4b) *orzeł–ϕ* [ɔʒɛw] ‘eagle’ *orł–a* [ɔrwa] ‘(id. gen.sg.)’
(4c) *dzień–ϕ* [dʑɛɲ] ‘day’ *dni–a* [dɲa] ‘(id. gen.sg.)’
(4d) *osioł–ϕ* [ɔɕɔw] ‘donkey’ *osł–a* [ɔswa] ‘(id. gen.sg.)’
(4e) *kocioł–ϕ* [kɔtɕɔw] ‘cauldron’ *kotł–a* [kɔtwa] ‘(id. gen.sg.)’

(5)
(5a) *kot–ek–ϕ* [kɔtɛk] ‘cat (dim.)’ *kot–k–a* [kɔtka] ‘(id. gen.sg.)’
(5b) *dom–ek–ϕ* [dɔmɛk] ‘house (dim.)’ *dom–k–u* [dɔmku] ‘(id. gen.sg.)’
(5c) *rząd–ek–ϕ* [ʒɔndɛk] ‘row (of seats) (dim.)’*rząd–k–u* [ʒɔntku] ‘(id. gen.sg.)”

(6)
(6a) *pies–ek–ϕ* [pʲ(j)ɛsɛk] ‘dog (dim.)’
pies–k–a [pʲ(j)ɛska] ‘(id. gen.sg.)’
(6b) *pies–ecz–ek–ϕ* [pʲ(j)ɛsɛtʃɛk] ‘dog (dim.dim.)’
pies–ecz–k–a [pʲ(j)ɛsɛtʃka] ‘(id. gen.sg.)’

Over- and Under- generalization in morphological learning

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Surfeit of the stimulus experiments (Moreton, 2008; Hayes et al., 2009; Becker et al., 2011), in which data contain patterns which are apparent to the analyst, but which human learners fail to learn, shed light on the nature of the human language learning faculty by demonstrating where and how it fails. This paper presents a natural language surfeit of the stimulus experiment, in which speakers mislearn a pattern apparent in the lexicon, overgeneralizing one output form at the expense of others. I present a model in which this overgeneralization is produced by incorporating both phonological knowledge and knowledge of the lexical type frequencies of each output form. I argue that adult speakers must know and employ lexical type frequencies in addition to phonological knowledge to produce novel morphological forms.

In Modern Hebrew, verbs must be minimally of the shape CVCVC. Verbs derived from nouns of shape CVC can take five shapes, depending on the quality of the noun's vowel. For a noun C_1VC_2:

Coronal glide formation:	C_1ijeC_2	(tik ∼ tijek)	V = [i,u]
Labial glide formation:	C_1iveC_2	(sug ∼ siveg)	V = [u,o]
Consonant doubling:	$C_1iC_2eC_2$	(dam ∼ dimem)	V = [a]
Vowel overwriting:	$C_1VC_2eC_2$	(kod ∼ koded)	V = [o]
Reduplication:	$C_1iC_2C_1eC_2$	(daf ∼ difdef)	V = [a,e]

In the lexicon, the noun's vowel predicts what form the verb will take (though not without exceptions).

A web-based wug-test (Berko, 1958) was conducted in which 27 native Hebrew speakers derived verbs from 20 novel nouns. Nouns were presented aurally in stories, and participants produced verbs by filling in a blank in a written sentence requiring a verb. A Poisson regression showed that although the noun's vowel significantly predicted the frequency of responses of each verbal type (as in the lexicon), one form - Consonant Doubling - was produced more frequently than any other, though it is not the single most common form in the lexicon.

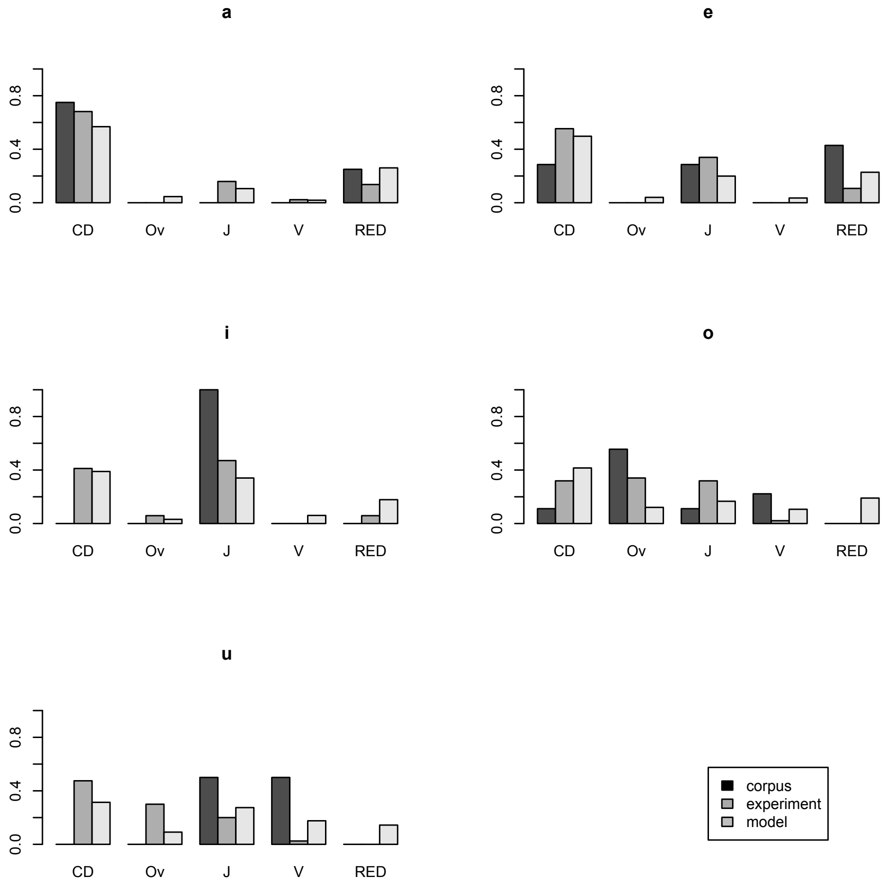
A graph (1, below) illustrates the surfeit of the stimulus effect. While in the lexicon the noun's vowel robustly predicts the frequency of each verbal form (the black bars), in the production data (the dark grey bars) the noun's vowel has a much smaller influence. Participants overgeneralized Consonant Doubling as an output, producing it more often and in more contexts than it occurs in the lexicon.

I present a Bayesian model of these data (the graph's pale bars), of the type proposed in Wilson and Davidson (2009), incorporating phonological knowledge, modeled with a Maximum Entropy learning algorithm (Goldwater and Johnson, 2003), the output frequencies of which are modulated by the lexical type frequencies of possible output forms.

Consonant Doubling violates the same faithfulness constraint (Max-V) equally for all input vowels. The faithfulness violations incurred by other forms depend on the noun's vowel (Coronal Glide Formation violates ID-syllabic for [i], but also ID-back and ID-round for [u]). Because of this property, the phonological component of the model extends Consonant Doubling to more contexts than it occurs in in the lexicon. The type-freqeuency component causes Consonant Doubling to be produced more frequently overall, since it occurs frequently in the lexicon.

In order to produce a good match to the experimental results, both the phonological and the output type-frequency component of this model are necessary. I conclude that adult Hebrew speakers have some knowledge of the type frequency of the outputs of morphological processes, and use this in conjunction with their phonological knowledge to produce new forms.

(1) Probability of verbal form by vowel. CD= Consonant Doubling; Ov= Vowel Overwriting; J= Coronal Glide Formation, V= Labial Glide Formation



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Equal sisterhood in prosodic structure

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Proposal: This paper proposes a new Optimality Theoretic (OT) constraint, which plays a role in the syntax–prosody interface. The constraint, EQUALSISTERS, is formulated in (1).

(1) EQUALSISTERS
Sister nodes in prosody are instantiations of the same prosodic category.

EQUALSISTERS is intended to replace the previously proposed constraints EXHAUSTIVITY and NONRECURSIVITY (Selkirk 1995), and WRAPXP (Truckenbrodt 1999). It is in this sense a new way to formulate the Strict Layer Hypothesis in OT. EXHAUSTIVITY, NONRECURSIVITY, and WRAPXP have become widespread in the literature on the syntax–prosody interface. However, Itô and Mester (in press) propose a new way of modeling prosodic structure, undermining the effects of EXHAUSTIVITY, NONRECURSIVITY and WRAPXP. Itô and Mester address the problem that many categories that have been assumed in the prosodic hierarchy are language specific. They replace categories that are redundant from a universal point of view with multiple layers of categories, i.e. recursion. As a result, Itô and Mester's model contains recursion in prosody which is not directly due to recursion in the morpho-syntactic structure. This causes problems for EXHAUSTIVITY, NONRECURSIVITY and WRAPXP. Data from Stockholm Swedish will illustrate the case for EQUALSISTERS. Stockholm Swedish is particularly well-suited for this illustration, since this language has phonological edge markers of intonation phrase left edges as well as right edges, making phonological structure easy to diagnose.

Data: The data set is given in (2) and (3). (2i) and (3i) show two different syntactic structures. Syntactically, (2i) is a coordination of two CPs, whereas in (3i), the leftmost CP is embedded into a larger CP. Three speakers of Stockholm Swedish read three sentences of each type. Two readings of each of the six sentences were analyzed. The prosodic patterns that the speakers used are given in (2a) and (3a–d) respectively. Round brackets indicate Phonological Phrase (PP) edges. Curly brackets indicate Intonation Phrase (IP) edges. The PP is defined as containing one *head accent*. (a.k.a. *focal accent*), which is a rising tonal contour on or after a stressed syllable (the rise appears in combination with a falling contour in so-called *accent 2* words). Head accents appear on the last word in focused constituents and, in all-new contexts, on the last word of the sentence, and often also on the subject (e.g. Bruce 1977, Myrberg 2010). The IP is the area between a left and a right edge tone. The right edge tone is most commonly L%. The left edge tone is a rise appearing on or right after the stressed syllable in the first word of the IP (Roll et al. 2009, Myrberg 2010).

(2) i) $_{CP}$[De andra skulle vara utklädda]$_{CP}$ $_{CP}$[så Anna ville inte vara med]$_{CP}$
the others would be dressed up so Anna wanted not be with
'The others were getting dressed up, so Anna didn't want to join.'

a) $_{IP}${ $_{IP}${$_{PP}$( )$_{PP}$ }$_{IP}$ $_{IP}${ $_{PP}$( )$_{PP}$ }$_{IP}$ }$_{IP}$

(3) i) $_{CP}$[$_{CP}$[Om blommorna ska trivas]$_{CP}$ så måste odlaren gödsla dem]$_{CP}$
if flowers-the will thrive so must grower-the fertilize them
'If the flowers are going to thrive, the grower must fertilize them.'

a) $_{IP}${ $_{IP}${$_{PP}$( )$_{PP'}$}$_{IP}$ $_{IP}${ $_{PP}$( )$_{PP}$ }$_{IP}$}$_{IP}$
b) $_{IP}${ $_{IP}${ $_{PP}$( )$_{PP}$ }$_{IP}$
c) $_{IP}${ $_{PP}$( )$_{PP}$ }$_{IP}$ $_{PP}$( )$_{PP}$ }$_{IP}$
d) $_{IP}${ $_{PP}$($_{PP}$( )$_{PP}$)$_{PP}$ }$_{IP}$

Analysis: The variation observed in (3a–d), as well as the single output structure in (2a), is modeled here with variable ranking in an OT-grammar (e.g. Bruce & Hayes 2001). It will be assumed that all logically possible rankings can occur. The OT-grammar proposed here selects each of the structures in (3a–d) under (at least) one ranking. When the input is (2i), (2a) is selected under all logically possible rankings, thus predicting the lack of variation observed in (2). The grammar consists of a set of *alignment constraints* (McCarthy & Prince

1993), which interact with EQUALSISTERS. The alignment constraints come in two types: those that ban prosodic edges without syntactic correspondents (prosody-syntax alignment, P-S), and those that ban syntactic edges without prosodic correspondents (syntax-prosody alignment, S-P) (Selkirk 2009, Cheng & Downing 2009). (It can be noted that the grammar would also work with so called *match constraints*, Selkirk (2009)). In Tableau 1, EQUALSISTERS is high ranked, and (3c–d) are ruled out. In (3c) an IP has a PP sister, and in (3d) a PP has a PW sister. (3c) and (3d) having been ruled out, the ranking between the two types of alignment constraints will select either (3a) or (3b) as the winner, even though these two candidates are less good than (3c) and (3d) in terms of their alignment (the two stars on rows a and b represent violations by IP and PP edges respectively). In Tableau 2, EQUAL-SISTERS is low ranked. Under this ranking, the candidate will win that best satisfies the alignment constraints. Either (3c) or (3d) will be selected. These two candidates reflect the embedding in the syntactic structure as embedding in the prosodic structure, and are therefore better aligned than (3a) or (3b).

Tableau 1.

	[[ ]]		EQ SIS	AL P-S	AL S-P
a	{{ ( ) } { ( ) }}			!**	
b	{ ( ) }	←			**
c	{{ ( ) } ( ) }		!*	*	
d	{ (( )) }		!*		*

Tableau 2.

[[ ]]		AL P-S	AL S-P	EQ SIS
{{ ( ) } { ( ) }}		!**		
{ ( ) }			!**	
{{ ( ) } ( ) }		!*		*
{ (( )) }	←		*	*

When the constraint set from Tableaus 1 and 2 takes as its input the syntactic structure in (2i), the candidate in (2a) does not violate any constraint. Since this candidate incurs no violations, it will win under any constraint ranking. EXHAUSTIVITY, NONRECURSIVITY and WRAPXP could not replace EQUALSISTERS in this grammar. EXHAUSTIVITY is satisfied by all the candidates in (3a–d), because all material is included both in a PP and in an IP on some level of the structure. WRAPXP is satisfied with respect to IP phrasing by all candidates. Though it might be considered to be violated by candidates (3a) and (3c), this does not help to account for the present data. NONRECURSIVITY rules out all structures except the one in (3b). When high ranked, it only allows (3b) to surface, thus failing to predict the existence of (3a). NONRECURSIVITY also causes a problem for the prediction that (2a) is the single output to (2i).

Conclusion: The prosodic hierarchy model proposed by Itô and Mester (in press) makes extensive use of recursion. Because of this, the constraints EXHAUSTIVITY, NONRECURSIVITY and WRAPXP fail to make correct predictions with respect to the syntax–prosody interface. This paper proposes to replace these three constraints by EQUALSISTERS.

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Stress in morphology-dependent systems when morphology is absent: A case study from L2 Greek

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In *morphology-dependent* stress systems the computation of stress is to a great extend decided on the basis of lexically pre-specified information (e.g., Melvold 1990; Idsardi 1992; Alderete 1999 et seq.; Revithiadou 1999). For instance, a suffix or a stem may attract stress because they are specified to carry stress or impose stress on another morpheme, e.g., Russian *ze!rkalo, zerkala*! 'mirror-nom.sg/-nom.pl', Greek *Ta!lasa, Talaso!n* 'sea-nom.sg/-gen.pl'. As a result, there exists more than one choice for the position of stress in the language, e.g., Greek, *Ta!lasa, Talaso!n, aVela!Da, aVela!Don* 'cow-nom.sg/-gen.pl' *petonja!, petonjo!n* 'string-nom.sg/-gen.pl'. A pivotal question therefore is which one represents the default, that is, the language-specific *elsewhere* pattern which arises when lexical information on stress is lacking. However, this question proved to be not an easy one to answer. In Russian, for instance, both initial (Halle 1973, 1997; Melvold 1990, a.o.) and post-stem stress (e.g., Alderete 1999) have been proposed to represent the default. To complicate things more, a series of nonce-probe experiments on Russian (Nikolaeva 1971; Crosswhite et al. 2003) revealed that the speakers' productions favored stem-final stress. These results, however, are in conflict with the findings of recent (experimental) studies (Andreev 2004; Fainleib 2008; Lavitskaya & Kabak 2011a,b) which appoint penultimate stress as the default. It is evident, therefore, that as far as the phonological aspect of lexical stress systems is concerned, we still walk on murky ground.

A great deal of confusion in the literature results from the fact that the *elsewhere* pattern that arises in the absence of inherent stress information (*phonological default*) and the pattern that emerges as the most preferred one in the speakers' productions (*emerging default*) are often seen as two sides of the same coin. In this paper, we propose that these patterns should be teased apart. In order to establish this claim, we examined how stress in a morphology-dependent system like Greek is shaped when: (a) morphology is at its weakest, i.e., elements that normally interfere through their underlying stress in the process of accentuation, such as inflectional markers, are not available to the speaker, and (b) whatever is left, i.e., the stem, lacks a specific accentual imprint. For this purpose, we designed a production experiment using unfamiliar acronyms, which lack a fixed stress pattern, e.g., [VaDa] Γ.Α.Δ.Α. 'General Police Agency of Attika', [Doatap] Δ.Ο.Α.Τ.Α.Π. 'National Academic Recognition Information Center', as experimental stimuli. Their familiarity status was established on the basis of the word frequency scores of the HNC/ILSP corpus (http://hnc.ilsp.gr/) and of google search. Furthermore, we applied the experiment to (i) native speakers of Greek and (ii) Russian L2 speakers of Greek.

If the phonological default and the emerging default are identical in Greek, the native speakers' group was expected to overapply APU stress in acronyms; if some other pattern, e.g., PU or U stress, is preferred in the speakers' responses, then APU is not the productive language pattern but a theoretical construct which simply represents the non-lexically inflicted stress. Similarly for L2, if the *Default Values Hypothesis* (Van de Pas & Zonneveld 2004) and the *Stress Deafness Hypothesis* (Dupoux & Peperkamp 2002; for L2 see also Kijak 2009) hold for L2 production, Russian L2ers are expected to either overapply the most unmarked pattern or faithfully produce the most productive pattern of the target-language, respectively. This would be the APU if the phonological and the emerging default coincide, and the PU or U, otherwise.

Turning now to the details of the experimental tasks, we conducted two experiments which involved the oral production of acronyms by a group of 21 Greek adults and 20 Russian advanced learners of Greek. The experimental stimuli consisted of 140 sentences of a simple SVO order. There was a gap in the subject position which had to be filled with a non-frequent acronym (60 gaps, 10 items x 6 acronym shapes) or a pseudoword (80 gaps, 10 items x 4 morphological categories, -os, -a, -i, -o, 40 disyllabic & 40 trisyllabic words). The acronyms were controlled for: (a) the type of final segment (consonant vs. vowel), (b) the size of the word (di-/trisyllabic), and (c) the effect of syllable type (e.g., close vs. open). We collected 2940 items in total, which were codified by the experimenters according to speaker, type of word (acronym or filler), word size and stress pattern.

The findings of the two experiments revealed that there is a strong aversion for APU stress and a high preference for PU stress by both groups. Interestingly, the Russian participants produced the same stress patterns as the Greek speakers and, impressively, in comparative percentages. In line with Kijak (2009), we claim that the Russian L2ers actively apply the most productive part of the target system to morphology-free novel words because this strategy is familiar to them from their L1 and hence easy to implement. An interference of lexical skewedness of the mother-tongue or of the target-language may also be a relevant factor, depending on level of proficiency and exposure to the target language. These results suggest that a hidden phonological system, distinct from the language-specific default, emerges in the absence of morphological conditioning. We discuss these results in relation to the results of other experimental studies on Russian (Crosswhite et al. 2003; Fainleib 2008; Lavitskaya & Kabak 2011a,b) and propose an approach that accommodates both patterns in the core of the Greek stress system.

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Processing (un-)predictable word stress in Polish: an ERP study

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The goal of this paper is to examine the neural processing of prosodic information by Polish speakers. As is well known, speech perception is to a large extent influenced by the phonological system of the listener's native language. Phonological properties form a relevant set of reference points for speech perception, including word stress patterns. A number of studies provided evidence showing that the degree of predictability of stress positions in a word is linked to the degree of sensitivity to stress variation (determined by L1 prosodic patterns) and, in turn, the capacity to process stress information on an abstract level. Dupoux et al. (2001) and Peperkamp et al. (2010) showed that native speakers of a language with a predictable stress pattern (e.g., French and Hungarian) do not have stress information stored in the lexical representation. This results in difficulties when memorizing stress contrasts, and leads to the "stress deafness" effect. The typology of deafness proposed by Peperkamp & Dupoux (2002) on the basis of several European languages with predictable stress also accounts for Polish, in which speakers' stress deafness is argued to be small but significant.

Polish has fixed word stress with a default pattern on the penultimate syllable, irrespective of the morphological composition of a word. There are, however, exceptions in the verbal and nominal paradigms which require stress to fall on the antepenult. These two patterns are examples of right-headed words, well-attested in languages with fixed stress. The unusual prosodic fact about Polish is that word-initial stress is allowed as well; it is used in emphatic speech, and, more importantly, as secondary stress. Given that it is highly unusual for a language with fixed penultimate stress to have left-headed exceptions, i.e. with initial stress (Goedemans & van der Hulst 2011), the study of word stress processing in Polish becomes particularly noteworthy.

The present experiment measures electrophysiological responses of the brain, so called event-related potentials (ERPs), to native words with correct and incorrect stress. The study constitutes an extension of previous findings showing that speakers of languages with predictable stress had difficulties with processing and representing prosodic information from languages in which stress pattern was distinctive. Research questions addressed in this contribution concern the status of the three stress patterns and their cognitive processing, on the one hand, and the verification of the claim regarding stress deafness in Polish speakers, on the other. More specifically, we are interested in discovering differences in the online processing of words with correct penultimate and antepenultimate stress in comparison to violations involving penultimate, antepenultimate, and initial stress. At a more general level, we aim to discover whether the location of word stress is linked to the presence of stress deafness, and ultimately what role stress and prosodic structure play in word processing.

An ERP study was conducted with 30 native speakers of Polish (15 men) who were presented with a set of 30 quadrisyllabic words with correct penultimate or antepenultimate stress each. For each stress pattern, all the words were naturally spoken by a linguistically trained female monolingual speaker of Polish, who pronounced each word with various stress patterns in a carrier sentence (On powinien powiedzieć ... wiele razy 'he should say ... many times'), resulting in three differently stressed forms (initial, penultimate and antepenultimate stress) and two stress conditions (correct and incorrect). Each trial started with the visual presentation of the critical items before the stimuli were presented auditorily. The participants' task was to judge the correctness of the encountered words with correct or incorrect stress. This method and violation paradigm has proven to be successful in the experiments by Domahs et al. (2008).

The ERP study revealed asymmetrical results for the three presented stress violations. In comparison to correct conditions with penultimate and antepenultimate stress, violations involving initial stress produce enhanced positivity effects between 200 and 500 ms post word onset. Violations involving antepenultimate stress when penultimate stress is target produce a biphasic ERP component: a broadly distributed negativity between 200 and 400 ms followed by an enhanced positivity between 600 and 1000 ms. In contrast, violations with penultimate stress in the context of antepenultimate target reveals a negativity between 250 and 550 ms, but no positivity effect at all. In analogy to previous ERP findings (Domahs et al. 2008) we interpret the positivity effects as instances of the P300 family reflecting the detection of an unexpected stress pattern that violates the expectation given by the visual input prior to the auditory presentation. As regards the negativity effects, we assume this component to indicate effects on the lexical processing of words violating phonological properties of the target form.

From these findings we conclude that initial stress – although used in emphatic speech and regarded as a bearer of secondary stress – violates the expectation towards a specific stress pattern. The early P300 even suggests that words with initial stress are rather judged as illegal Polish words. In this respect, the data speaks against approaches suggesting initial stress to be an alternative stress pattern to penultimate stress. As regards violations with antepenultimate and penultimate stress, the results support the default status of penultimate stress in comparison to antepenultimate stress: penultimate stress in the context of words with target antepenultimate stress meets the expectation to encounter target stress as reflected by the lack of a P300 effect, whereas violations with antepenultimate stress in the context of words with target penultimate stress do show a violation effect. The only effect found for violations involving penultimate stress is an N400 effect to reflect a lexical deviation when using the default instead of the lexically specified antepenultimate stress pattern.

These results provide evidence for the asymmetrical processing of default and non-default stress, confirmed by the fact that participants have difficulties to judge the correctness of the default stress pattern, while lexicalized patterns are processed more attentively. However, the accuracy scores obtained from the judgments do not support the asymmetrical results for penultimate and antepenultimate stress in the brain responses, but are rather poor for each incorrect condition (ranging from 56 to 68%). Thus, the behavioral data indicates that the Polish participants generally have difficulties to judge the ill-stressed items presented in this experiment, whereas the ERP data are able to disentangle the processing of qualitatively different violations.

To summarize, the ERP data supports previous findings that native speakers of Polish are to some extent insensitive to stress information, i.e. they have problems to decide whether stress is assigned correctly or not. Further implications for structural properties of Polish are that initial syllables are not accepted as alternative main stress positions.

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What's in a cluster?

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Government Phonology (Kaye, Lowenstamm & Vergnaud 1985, 1990, Kaye 1995) derived the phonotactics of coda-onset clusters (COs) of the shape C_1C_2 from two principles:

(**P1**) C_2, the governor, is charmed (where charm is an inherent property of elements passed on to entire consonant) and C_1, the governee, charmless, or

(**P2**) C_2 is at least as complex as C_1 (complexity: number of elements).

In *winter* charmed *t* (C_2) governs charmless *n* (C_1) by (**P1**), while in *helmet* *l* (C_1) and *m* (C_2) are both uncharmed, but *m* more complex than *l* (**P2**).

Empirical problems. *Chapter*/*actor* require charmless governees *p*/*k* by (**P1**). They differ from charmed *p*/*k* that can govern, e.g. the nasal in *temper*/*tanker*. No independent evidence for charmless *p*/*k* has ever been given and it is unclear why English lacks charmless *t* (why **tp*/**tk* are out). Also, the lack of **chabder*/**agdor* remains completely unexplained.

Theoretical problems. Charm was abandoned in the 1990s, making (**P1**) useless. Moreover, the set of elements has been shrinking over the years, making complexity and (**P2**) problematic. COs became a mystery.

Proposal. Most theories of COs, also that of Kaye, Lowenstamm & Vergnaud (1990), rely on "major class features" such as sonorant vs. obstruent (partly expressed by charm, partly by particular elements). Place properties usually play a subordinate role in phonotactics, if any role at all. For a clear, recent statement against such a one-sided view, cf. van der Torre (2003), in whose spirit the following proposal is made: <u>A successful theory of COs can be built around the element **A** acting as the "glue" keeping COs together.</u> **A** is the element expressing coronality in consonants, in other words: a place property. Reference to "major class features" is not required.

Ignoring nasal-obstruent clusters and *sC* for now (more on which below), every CO contains **A**: either in C_1 (*rC*, *lC*: "sonorant-obstruent") or in C_2 (*pt*, *kt*: "obstruent-obstruent") – a fact usually unmentioned in the GP literature. I formalise this as follows:

(**1**) C_1 of a CO must be A-licensed.

(**2**) C_1 is A-licensed iff (**2.1**) it contains **A** in <u>non-head</u> position
or (**2.2**) is A-governed.

(**3**) A-governing: C_2 A-governs C_1 iff C_2 contains **A** in <u>head</u> position.

The proposal relies on whether the element **A** is head in a given sound or not. Following Kaye (2000) and Goh (1996), I assume that **A** is a head in *t*, *d*, *n* and a non-head in *r* and *l*. (For an alternative interpretation of the notion head(edness) cf. Pöchtrager 2006.)

Some examples will illustrate (**1–3**): In *helmet* *l* contains non-head **A**, thus C_1 is A-licensed by (**1/2.1**). Prediction: there should be no restrictions on C_2, which is (nearly) 100% correct: any consonant possible in that position of the foot (except *r*) can follow *l*. In *actor*, C_1 does not contain **A**, hence, C_1 needs to be A-governed (**2.2**) in order to be A-licensed (**1**). In other words, C_2 needs to contain **A** as a head. Again, this fits the facts, as we have *kt* but **kp*: *p* does not contain **A**, hence cannot A-license C_1, but *t* contains **A** in head position. Note furthermore that the asymmetry head/non-head in **2.1**/**3** exludes *t*, *th* as C_1 and *r*, *l* as C_2 excluding **tp*, **tk*, **thk* etc. as well as **kl*, **pl* etc. as COs. (Of course *kl*, *pl* etc. do occur as branching onsets, on which more below.)

One further assumption derives *pt*/**bd* etc., i.e. the fact that in an obstruent-obstruent cluster in English there is only one possibility as regards the laryngeal settings (unaccounted before):

(**4**) C_2 can either be fortis or A-license (but not both).

In *chapter* C_1 does not contain **A**, so it must be A-licensed by C_2. C_2 contains **A** as the head and can thus fulfill the role as A-licenser. But since C_2 needs to A-license, it cannot be fortis at the same time, i.e. the *t* is really lenis here, i.e. *d*, independently argued for in Pöchtrager (2006). That result, together with the assumption that C_1 cannot vary in laryngeal settings independently (also argued for in Harris 1994), makes sure that there is only one option for an obstruent-obstruent CO.

Note furthermore that the principle in (**4**) makes the correct predictions about clusters like *l*C and *r*C with respect to source properties: Here, C_1 is A-licensed by virtue of its own **A**-element in non-head position and therefore imposes no restriction on the laryngeal settings of C_2: *album* is as good as *alpine*, *sturdy* as good as *dirty*.

Further issues. The principles presented above account for the major part of the cases found in Germanic and Romance languages. As one goes deeper, further issues arise:

(**F1**) The element **L** (nasality) seems to be the other kind of "glue", making **A** dispensible, e.g. in *mp* neither member contains **A**, yet the cluster is licit (*temper*). An affinity between **A** and **L** has been shown before (Ploch 1995), but has never been followed up. While it remains unclear why this similarity in behaviour exists, it is clear that **L**'s "gluing" properties are very similar to those of **A**. If **L** occurs in the first member, the second member is relatively unrestricted, also in its laryngeal setting, cf. *winter* and *window* etc. And, just like **A**, we also find it in C2, as in *technical* or *acme*. (The status of such clusters as CO is demonstrated by the fact that they can only be preceded by short vowels, like other COs.)

(**F2**) Kaye, Lowenstamm & Vergnaud (1990) argue that the mirror image of a branching onset is a good CO (though not the reverse). Indeed, **A** also plays a role in branching onsets: C_2 usually contains (non-head) **A** (*br*/*dr*/*gl*/*pl*...). While the present proposal restricts itself to COs, it seems clear that any account of branching onsets must build on the properties of **A**, too. Note that in *tw* (argued to be a branching onset by Harris 1994) as in English *twin* it is the first member that contains **A**.

(**F3**) *s*C-cluster have proved notoriously difficult, and interestingly enough, it seems that in the current model they take a middle position between the two possibilities that are given by (**1–4**): *s* contains **A** in non-head position (Kaye 2000), so C_1 is A-licensed and any consonant should be possible as C_2. This is true, again with the exception of *r*. However, C_2 can only be lenis (Pöchtrager 2006), which is a restriction one should expect of a clusters whose first member does not A-license itself.

(**F4**) Kaye & Pöchtrager (2009) propose that there is no element **A** and that it be replaced by structure. (**1–3**) can be so translated without losing any insights, but maybe explaining why **A** acts as glue: if **A** is a structural configuration, it can be understood as providing the room for the other member of the cluster to be plugged in.

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Rhyming in echo-reduplication

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In this paper, we propose that Russian echo-reduplication is subject to essentially the same rules as rhyming. Evidence comes from the observation that the domain of identity in echo reduplication is defined in the same way as the rhyming domain in rhymed poetry.

Furthermore, we hypothesize that echo-reduplication creates rhyming pairs – as opposed to merely copying a substring of the base – in all Indo-European languages that possess it. As rhyming traditions differ, so do corresponding echo-reduplication systems.

Russian *xuj*-reduplication

Xuj-reduplication is one of the most productive echo-reduplicating processes in colloquial Russian (cf. description in Belikov 1990). It can apply to almost any phonological word (including phrases with single stress, as in (1d)) to derive an echo-reduplicated variant in which some material of the second copy is overwritten with the string *xuj*.

(1) a. mál^{j}čik-*xuj*ál^{j}čik ‘boy-shmoy’
b. voróčat^{j}s^{j}a-*xuj*óčat^{j}s^{j}a/ *xuj*oróčat^{j}s^{j}a ‘tumble-shmumble’
c. ná pol-*xuj*ápol ‘onto the floor’

Xuj can overwrite any string that directly precedes the stressed vowel or some other vowel before it. Exceptions from this general rule arise in the reduplication of words that end with a stressed vowel. In that case it is necessary that the consonant preceding the stressed vowel is preserved in reduplication, see (2).

(2) a. vodá-*xuj*dá/**xuj*á ‘water’
b. danó-*xuj*nó/**xuj*ó ‘given.neut’

Crucially, the same requirement is found in classic Russian poetry: "kazán" rhymes with "Korán", but "kozá" doesn't rhyme with "korá" (cf. Žirmunskij 1923 and others). Following the French tradition (Grammont 1911), we will call this *rime suffisante* (sufficient rhyme) requirement.

(3) *Rime suffisante* (RS) requirement:
For two words with stressed word-final vowels to rhyme, it is necessary that the consonants preceding the stressed vowels are identical.

A way to capture the similarity between poetry and echo-reduplication is to derive both from the same hierarchy of constraints.

A constraint-based analysis

The input for *xuj*-reduplication will be a pair of words of type <W, *xujX*>, where X is some non-null phonological string. Crucially, the words have to rhyme. This is ensured by a set of base-reduplicant faithfulness constraints that require identity of rhyming domains (RDs) of the two words Corr(RD) = {Max(RD), Dep(RD), Ident-F(RD), Linearity(RD), Contiguity(RD)}. The *rime suffisante* requirement is captured by the markedness constraint against monosegmental RDs: RD>1. Another constraint ensures that RDs contain a stress: Stress(RD). Finally, there is a constraint that requires RD to be aligned to the right Al-R(RD). See the tableaux below.

<vodá, xuj*X*>	AL-R (RD)	RD > 1	CORR(RD)	STRESS(RD)
☞vo[dá] xuj[dá]				
v[od]á x[ujd]á	*!		*	*
vod[á] xuj[á]		*!		
vo[dá] xuj[dú]			*!	

<pósle, *xuj*X>	AL-R (RD)	RD > 1	CORR(RD)	STRESS(RD)
☞p[ósle] xuj[ósle]				
pó[sle] xuj[sle]				*!

An analysis along these lines naturally extends to rhyming in Russian poetry (the input in case of poetry would be two strings of words). There, the domain of identity would be the rhyming domain in a strict sense — a right-aligned string that starts with a stressed vowel or a consonant preceding it in *rime suffisante* cases — which is notably always an option in *xuj*-reduplication, see examples in (1).

Echo-reduplication as rhyming

Cross-linguistically, it may turn out that all echo-reduplication cases are in fact generated by creating rhyming pairs (cf. similar ideas in Yip 1999). For example, English *shm*-reduplication data seems to be consistent with this claim. As shown in Nevins&Vaux 2003, the domains of identity in *shm*-reduplication may vary (*unbelievable-shmunbelievable / unshmelievable / unbeshmievable*), but their identity domain is always found at the right edge (satisfying Al-R)(RD)) and always contains the stressed vowel (**unbelievable-unbelieshmable*), i.e. they always contain rhyming domains, and so resulting pairs of words always rhyme. Since the rules of rhyming are slightly different in English and in Russian, the patterns of echo-reduplication are also slightly different. For instance, there is no *rime suffisante* requirement in English rhyming poetry, and hence, as expected, no such requirement in echo reduplication (pairs like *Joe-Shmoe* are attested).

The currently available evidence is consistent with the hypothesis that echo-reduplication creates rhyming pairs also in Hindi (*v*-reduplication, Nevins 2004, Zimmerman&Trommer 2011) and in Persian (m- and p-reduplication, Ghaniabadi 2005): in both cases reduplicated parts contain stress and are aligned to the right.

That said, we don't exclude the possibility that RDs of echo-rhymes can be subject to more stringent similarity requirements than normal RDs in verse. In fact, this is often the case. For example, in Russian x*uj* is able to overwrite C_1 of the cluster C_1C_2 if the resulting cluster jC_2 has more or less the same sonority contour as C_1C_2. See some data below[1].

(5) a. postá- *xuj*(o)stá / **xuj*tá / **xuj*á
b. Ostáp-*xuj*(o)stáp / **xuj*táp / ✓*xuj*áp
c. volná-*xuj*(o)lná / ✓*xuj*ná / **xuj*á
d. volnám-*xuj*(o)lnám / ✓*xuj*nám / ✓*xuj*ám

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[1] Note that similar conditions on the sonority contour of strings surrounding the RD are in fact attested in Old Irish (Ó Cuív 1966) and Skaldic rhymes (Arnason 2007).

How loanword phonology can provide evidence of the transition from positional faithfulness to contextual markedness

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1. Introduction. Optimality Theory has commonly made use of two types of constraints: faithfulness and markedness constraints (Prince & Smolensky 1993, McCarthy & Prince 1995). Moreover, both kinds of constraints admit to be relativized according to the position or the context to which they apply or are active. Indeed, in addition to standard faithfulness constraints and context-free markedness constraints, *positional* faithfulness constraints (Beckman 1998; Casali 1996, 1997) and *contextual* markedness constraints (Prince & Smolensky 1993) are generally invoked. Both kinds of constraints, however, are alleged to be redundant and thus mutually excluding, in that they do the same job. The former just interact with context-free markedness constraints: the effects of a general markedness constraint can be inhibited by the higher ranking of a faithfulness constraint which protects a segment, a feature, etc., in a specific structural position. The latter, on the other hand, interact with standard faithfulness constraints: the effects of a specific markedness constraint can be reduced by relativizing it to a specific context.

2. Goal. The purpose of this paper is to explore the relation between positional faithfulness and contextual markedness constraints, and to show how, in some particular cases and from a diachronic point of view, the latter can be interpreted as induced by the effects of the former into the grammar of languages throughout its historical development. Our proposal is illustrated with a set of cases of underapplication of vowel reduction which occur in some dialects of Catalan.

3. Data. In Majorcan Catalan (MC), the process of vowel reduction of the mid front vowels /e/ and /ɛ/ to schwa [ə] in unstressed position underapplies under certain circumstances: *a*) in productive derived forms with an unstressed vowel located in the initial syllable of the stem, which alternates with a stressed mid front vowel in the stem of the underived form (*p*[é]*ix* 'fish' ~ *p*[e]*ixet* 'fish *dim.*'; see also (1)); *b*) in verbal forms with an unstressed vowel located in the initial syllable of the stem, which alternates with a stressed close mid front vowel in another verbal form of the same inflectional paradigm (*p*[é]*ga* '(s/he) hits' ~ *p*[e]*gam* '(we) hit'; see also (2)); *c*) in learned and loan words with an unstressed *e* located in the initial syllable of the stem (*p*[e]*culiar* 'peculiar'; see also (3)).

4. Proposal. 4.1. *Alternating forms* (cases *a* and *b*). In Pons-Moll (in press a, b), it is argued that underapplication of vowel reduction to schwa in MC derivational and inflectional forms is a direct consequence of the interaction of the prominence constraint hierarchy banning certain vowels in unstressed position according to their sonority value and a set of output to output faithfulness constraints relativized according to two factors: the productivity of the derivational process and the position of the affected vowel within the stem (see the referred works for a more formal details about the proposal). 4.2. *Non-alternating forms* (cases *c*). Underapplication of vowel reduction to schwa in learned and loan words is also circumscribed to those cases in which the unstressed vowel is located in the initial syllable of the stem. In these cases, however, the unstressed vowel does not alternate with a stressed one. O-O *positional faithfulness constraints*, therefore, cannot explain this behavior, but *contextual markedness constraints* banning a schwa in this specific position (*i.e.*, the initial syllable of the stem) can. From a diachronic perspective, a plausible explanation of these facts is to consider that the activity of the O-O faithfulness constraints relativized according to the position of the vowel within the stem, responsible for underapplication of vowel reduction to schwa in productive derivation and inflection, that is, in the productive phonology of the dialect, and which have provoked a drastic reduction of the occurrences of the schwa in stem-initial position, have led, throughout time, to a reinterpretation of the unstressed vowel system by MC speakers. That is to say, the effects of the positional faithfulness constraints enhancing the appearance of [e], instead of [ə], in the initial syllable of the stem, would have been reinterpreted by MC speakers as a consequence of a contextual or positional markedness constraint of the type *ə/Initial-Syll-Stem, banning a schwa in the initial syllable of the stem and which at present is operating just in loanwords. Furthermore, the prediction is that this constraint will likely affect all kinds of words, motivating the massive disappearance of the schwa in this specific position.

DATA AND REFERENCES

(1) *Normal application* vs. *underapplication of vowel reduction in derivation*

BASE (UNDERIVED FORM)	PRODUCTIVE DERIVATION	NON-PRODUCTIVE DERIVATION
a. Stressed stem with [é] *or* [ɛ́]	*b. Unstressed stem with the vowel in the initial syllable of the stem* → unexpected [e]	*c. Unstressed stem with the vowel in the initial syllable of the stem* → expected [ə]
p[é]*ix* 'fish'	*p*[e]*ix*[ə́]*t* 'fish *dim.*'	*p*[ə]*ixat*[é]*r* 'fisherman'
t[ɛ́]*rra* 'earth'	*t*[e]*rr*[ə́]*ta* 'earth *dim.*'	*t*[ə]*rr*[é]*stre* 'terrestrial'
d. Stressed stem with [é] *or* [ɛ́]	*e. Unstressed stem with the vowel* not *in the initial syllable of the stem* → expected [ə]	*f. Unstressed stem with the vowel* not *in the initial syllable of the stem* → expected [ə]
pap[é]*r* 'paper'	*pap*[ə]*r*[ə́]*t* 'paper *dim.*'	*pap*[ə]*rera* 'paper basket'
fid[ɛ́]*u* 'noodle'	*fid*[ə]*u*[ə́]*t* 'noodle *dim.*'	*fid*[ə]*u*[á]*da* 'noodle dish'

(2) *Normal application* vs. *underapplication of vowel reduction in inflection*

STRESSED-STEM VERBAL FORM	UNSTRESSED-STEM VERBAL FORM
a. Stressed stem with [é] or [ɛ́]	*b. Unstressed stem with the vowel in the initial syllable of the stem* → unexpected [e]
p[é]*ga*, *p*[é]*gues*, *p*[é]*gui*, *p*[é]*guis*, *p*[é]*guen* 'to hit' verbal forms	*p*[e]*g*[á]*m*, *p*[e]*g*[á]*u*, *p*[e]*gar*[é], *p*[e]*gar*[í]*es*... 'to hit' verbal forms
esp[é]*r, esp*[é]*res, esp*[é]*ra, esp*[é]*ri, esp*[é]*rin* 'to wait' verbal forms	*esp*[e]*r*[á]*m*, *esp*[e]*r*[á]*u*, *esp*[e]*r*[á]*ssis* 'to wait' verbal forms
c. Stressed stem with [ɛ́]	*d. Unstressed stem with the vowel in the initial syllable of the stem* → expected [ə]
x[ɛ́]*rr*, *x*[ɛ́]*rra*, *x*[ɛ́]*rren*, *x*[ɛ́]*rris*, *x*[ɛ́]*rren* 'to chat' verbal forms	*x*[ə]*rr*[á]*m*, *x*[ə]*rr*[á]*u*, *x*[ə]*rrar*[í]*es* 'to chat' verbal forms
at[ɛ́]*rra*, *at*[ɛ́]*rren*, *at*[ɛ́]*rri*, *at*[ɛ́]*rrin* 'to land' verbal forms	*at*[ə]*rr*[á]*m*, *at*[ə]*rr*[á]*u*, *at*[ə]*rrar*[í]*es*... 'to land' verbal forms
e. Stressed stem with [é]	*f. Unstressed stem with the vowel* not *in the initial syllable of the stem* → expected [ə]
cont[é]*st*, *cont*[é]*stes*, *cont*[é]*sta*... 'to answer' verbal forms	*cont*[ə]*st*[á]*m*, *cont*[ə]*st*[á]*u*, *cont*[ə]*star*[í]*a*... 'to answer' verbal forms
acc[é]*pt*, *acc*[é]*ptes*, *acc*[é]*pta*... 'to accept' verbal forms	*acc*[ə]*pt*[á]*m*, *acc*[ə]*pt*[á]*u*, *acc*[ə]*ptar*[í]*a*... 'to accept' verbal forms

(3) *Normal application* vs. *underapplication of vowel reduction in inherited and loanwords*

a. LEARNED AND LOAN WORDS		*b*. INHERITED WORDS	
p[e]*culi*[á]*r*	'peculiar'	*p*[ə]*ssig*[á]*r*	'to pinch'
p[e]*d*[á]*l*	'pedal'	*b*[ə]*s*[á]*da*	'kiss'
p[e]*l·l*[í]*cula*	'film'	*b*[ə]*ss*[ó]	'twin'
comm[e]*mor*[á]*r*	'to commemorate'	*m*[ə]*nt*[í]*da*	'lie'
llargm[e]*tr*[á]*tge*	'feature film'	*m*[ə]*l*[ó]	'melon'
imp[e]*c*[á]*ble*	'impeccable'	*p*[ə]*ned*[í]*r-se*	'to regret'
m[e]*dic*[í]*na*	'medicine'	*m*[ə]*norqu*[í]	'Minorcan'
f[e]*l*[í]*ç*	'happy'	*f*[ə]*ix*[ú]*c*	'heavy'
f[e]*titx*[í]*sme*	'fetishism'	*f*[ə]*r*[í]*r*	'to hurt'
v[e]*rm*[ú]*t*	'vermouth'	*v*[ə]*ll*[ú]*t*	'velvet'
v[e]*rb*[é]*na*	'party'	*v*[ə][í]	'neighbor'

The phonological status of voiced palatals and labiodentals in German

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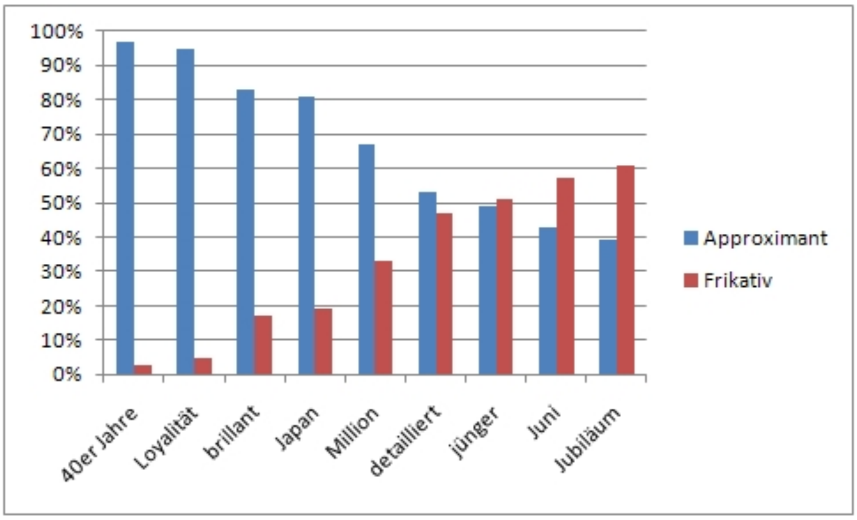
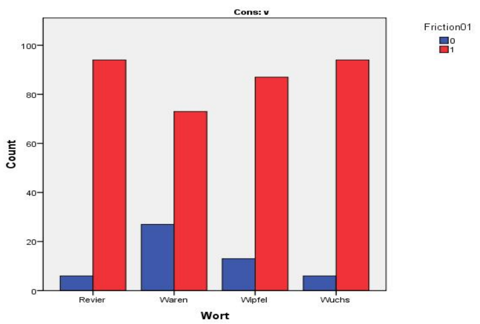
The phonological status of the initial segments in German *ja* 'yes' and *was* 'what' is controversial. While most authors treat both sounds as fricatives [j] and [v], respectively, which function as the voiced counterparts of the voiceless fricatives [ç] and [f], others treat the initial segment in *ja* as an approximant [j] (Kohler 1995, Pompino-Marschall 1995), some also treat the initial segment in *was* as an approximant [ʋ] (Scherer & Wollmann 1985, Kohler 1995, Hamann & Sennema 2005). Both sounds have been treated as allophones of high vowels (Morcienic 1958, Hall 1992).

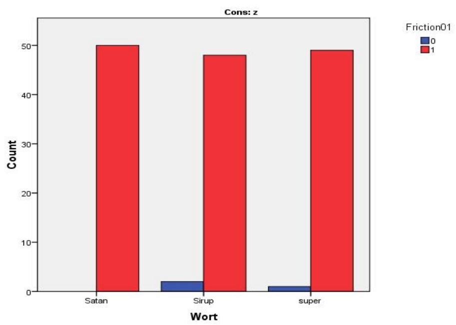
The goal of the present paper is to clarify the status of the relevant two segments in modern standard German on the basis of new empirical phonetic and phonological studies. To exclude regional pronunciations, the phonetic study is based on 20 words read by 100 young speakers from 26 towns in the northern and western part of Germany, generally considered as the area where "standard German" is spoken. The data are part of the speech corpus "German Today", which was compiled at the IDS Mannheim, cf. Brinckmann et al., (2008). Measurements by Brinkmann (to appear) confirm the claim that what is traditionally described as a fricative [j] is rather an approximant, where friction occurs only as a function of the degree of the aperture of the following vowel. When an open vowel follows, friction occurs in less than 20 percent of the cases:

(1)



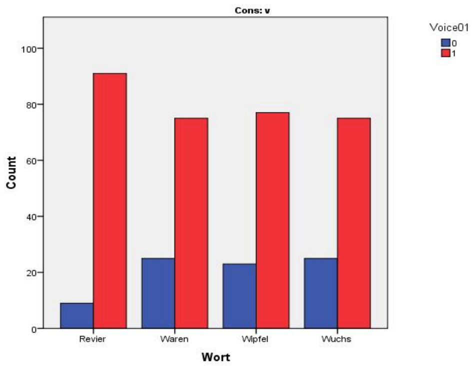
Regarding the status of the labiodental segment our measurements show significant differences in friction with respect to the palatal approximant described in (1) (cf. (1) and (2)). However, they also show significant differences in voicing and friction with respect to the fricative /z/ (cf. (2) and (3)) .

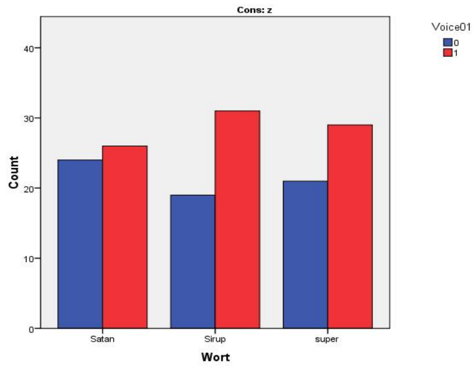




(2) (3)

The difference in friction in (2) and (3) correlates with a significant difference in voice (cf. (4) and (5):





(4) (5)

The difference in voicing may result from the fact that voiced and voiceless labiodentals contrast initially in German, while alveolar fricatives are all voiced. Consequently, it is more important to realize voicing in labiodentals (Flemming 1995). The difference in friction may in turn be a consequence of the voicing difference.

The phonetic data would consequently be consistent with an analysis of both the voiced labiodental and the voiced alvealar as fricative phonemes, an analysis which is supportd by the phonological evidence. [v] and [f] exhibit regular voicing alternations on a par with [z] and [s]. A detailed study based on CELEX-data shows moreover that the distribution of vowels preceding clusters which include [v] consistently confirms its status as a true fricative: only lax vowels occur before sonorant-[v] clusters, as the sonorant closes the syllable (e.g. *S*[ɪ]*l.vester*), only tense vowels precede /v/-/ʀ/-clusters, as such clusters form complex onsets, where the preceding syllable is open (e.g. [ø.vʀə] 'Œuvre').

The difference in friction between (1) and (2) is consistent with phonological evidence which shows that the palatal approximant represents the phoneme /i/ in onset position. This claim, too, will be supported with new data, focusing on the occurrence of [j] before [i].

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The intonational system and the prosodic hierarchy of Embosi
(Bantu C25, Congo-Brazzaville)

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The aim of the talk is twofold: it presents a study of the intonational system of Embosi, a 2 T Bantu language without downstep (or downdrift), proposing a model with a dual register organization, to account for its data, in particular, the interaction between lexical tones and boundary tones. It also investigates the Prosodic Hierarchy showing that there is no Phonological Phrases.

Embosi is a Bantu language (C25) spoken in Congo-Brazzaville. The main characteristics of its tonal system are the following: it has 2 tones, L and H, and its tone bearing unit is the mora. All lexical (and grammatical) tones get associated to a mora as a result of various tone processes and there is no downstep triggered by floating L tones. Tonal contours are not permitted even at the end of words. There are constraints again them, which trigger rather complex processes to avoid them, in any context where they would occur.

In our study of Embosi intonation, we will assume two prosodic constituents above the Phonological Word: Prosodic Phrase, and Intonational Phrase. Their characteristics are the following:

1) Prosodic Phrases (PP). PPs are constituents in which tonal registers (= register of tone realizations) are defined. They don't exhibit any downstep but their tonal realizations are more or less expanded or compressed. These tonal registers depend upon information structure and predictability. In syntactic terms the domain of these PP varies from a word to a whole sentence.

2) Intonational Phrases (IP). We will assume that they are characterized by a boundary tone, which seems very common. However, in Embosi boundary tones are different from lexical or grammatical tones: they are not realized on the two H and L tone levels, within a tonal register. They are superimposed to tones, triggering extra-high or extra-low tones. A dual register organization can be suggested with tonal registers and intonational registers, the last ones including the previous ones. Boundary tones are tones within intonational registers. As it might be expected, these two types of tones interact and there are alignment constraints between them. Thus, a H% is not realized at the end of IPs but it is attracted by the last H of the IP, which might be not IP final (and will be realized higher than a H tone). The distribution in respect to syntax and information structure of the "superimposed boundary tones" H% and L% is reminiscent of the distribution of "regular" H% and L% in many languages, such as French or English among them.

Between the Phonological Word (PW), which is characterized by a set of segmental rules (Beltzung & al. 2010) and the Prosodic Phrase, there is no evidence for Phonological Phrase (as found for example in Chichewa). In Embosi, there is no penultimate lengthening as in some Bantu languages, and there is no leeway for a penultimate or final lengthening as this language has a contrast between short and long vowels and has even three moraic vowels originating from compensatory lengthening. There is no segmental or tonal rule referring to this domain, while there is a very productive hiatus reduction rule occurring between two PW in any point within a sentence, whenever the conditions of its application are met.

The study is currently based on 1) on two read corpus, organized to study relatives clauses, and -wh questions with a total of 200 sentences by one speaker (the second author), 2) on two interviews totalling 15 minutes, conducted and recorded by the second author in Brazzaville.

This intonational study is the first one on a Bantu language of this zone. It presents a system without downstep, with register shifts, in which boundary tones are superimposed on tones and not inserted on the same line. Moreover, Embosi exemplifies a Prosodic Hierarchy without Phonological Phrases, which seems to be a rare as the absence of Phonological Phrase has been argued for only in few languages (Northern Sotho, another Bantu language, Zerbian 2006 and West Greenlandic, Arnhold to appear). However, we think that this scarcity of examples is probably due to a lack of documentation and/or analysis of prosodic structures in many languages. Current theories of prosody/syntax interface have to take into account these data, which challenge the generality of various proposals expressed either in terms of ALIGN-constraints or WRAP-constraints.

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Downstep of rising-falling sandhi tones in Wenzhou Chinese

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This study addresses the issue of pre-planning in sentence production by examining the downstep patterns of tonal realization in Wenzhou Chinese. To account for the phenomenon of *downstep*, i.e. the successive lowering of tonal or pitch accent peaks, two competing accounts have been put forward. Proponents of the *global hypothesis* argue that the height of pitch peaks is pre-planned over the entire sentence, and that the height of the initial peak depends on the sentence length (Bruce 1977; Sorensen and Cooper 1980). The *local hypothesis*, on the other hand, suggests that the height of successive pitch peaks is computed from one peak to the next, and independent of sentence length (Pierrehumbert 1979; Liberman and Pierrehumbert 1984). We will bring in evidence from Wenzhou Chinese, and argue that the pitch pre-planning process in this language is neither global nor local; rather, syntactic constituents play a role in determining the domains of downstep.

Wenzhou Chinese relies heavily on prosodic structuring to organize the realization of lexical tones in sentences (Chen 2000). In this dialect, tones in disyllabic words undergo a regular tone change process (tone sandhi) and surface with specific output patterns. An example for this is the rise-fall sandhi pitch contour, which surfaces when a dipping tone is preceded by any other lexical tone in a disyllabic word. This pitch contour provides a good basis for the investigation of tonal scaling and downstep. In the current study, we examined the pitch scaling of this rise-fall contour embedded within subject and object noun phrases of different length as illustrated in (1-3). Here, (1) shows the basic structure, (2) lists stimuli varying only in the number of words within the object, and (3) lists stimuli varying in subject length. 19 young speakers of Wenzhou participated in the experiment.

(1)	(美国	(大学	(同学)))	学习	(重要	(算术	(公式)))
	American	university	classmate	learn	important	math.	formula

'The (American (university (classmate))) learns the (important (mathematical (formula))).'

(2) Increasing object complexity

a. SSS-V-O 'The American university classmate learns the formula.'
b. SSS-V-OO 'The American university classmate learns the mathematical formula.'
c. SSS-V-OOO 'The American university classmate learns the important math. formula.'

(3) Increasing subject complexity

a. S-V-OOO 'The classmate learns the important mathematical formula.'
b. SS-V-OOO 'The university classmate learns the important mathematical formula.'
c. SSS-V-OOO 'The American university classmate learns the important math. formula.'

For analysis, the F0 maxima and minima within each word were measured and compared between the different constituent lengths using Repeated Measures ANOVAs. Results show that in sentences illustrated in (2), the first peak of the object was higher when the object contained more words ($F(2, 18) = 6.526$, $p = 0.004$) (Figure 1). Likewise, in sentences illustrated in (3), the first subject peak was raised when the subject consisted of more words ($F(2, 17) = 10.674$, $p < 0.001$) (Figure 2). This pitch scaling effect was confined to individual constituents: More words in the subject constituent did not affect the height of the first object peak, and vice versa. So, in Figure 1, the scaling of the initial subject peak remains the same, regardless of overall sentence length (S1 height: $F(2, 18) = 0.006$, $p = 0.994$, n.s.). Similarly, in Figure 2, the scaling of the first object peak shows no significant height difference, regardless of its relative position within the sentence (3rd, 4th or 5th word) (O1 height: $F(2, 17) = 0.089$, $p = 0.915$, n.s.).

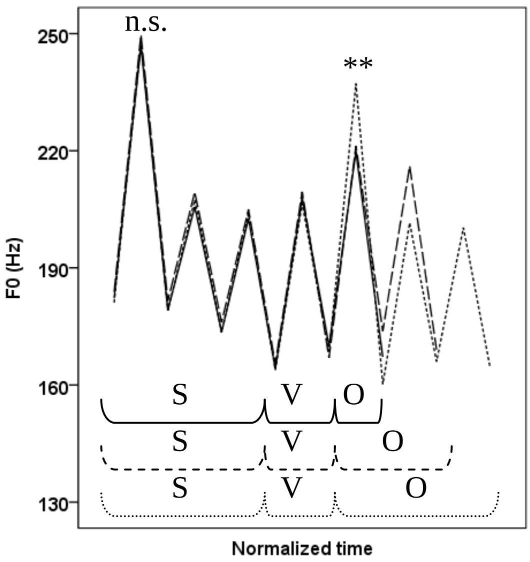

Figure 1. F0 maxima and minima for sentences with 3 subject and 1-3 object words

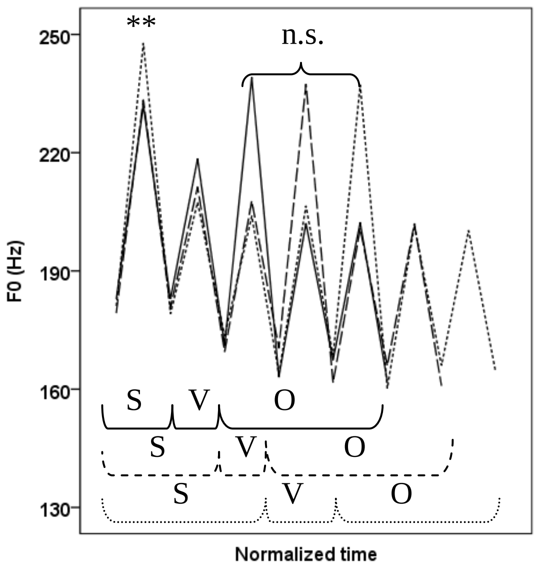

Figure 2. F0 maxima and minima for sentences with 1-3 subject and 3 object words

Our results suggest that the pre-planning process of F0 scaling in Wenzhou is limited by the constituent boundaries, and independent of overall sentence length. The findings therefore neither fully align with theories of global pre-planning, nor with theories of tone-to-tone computation of pitch peak scaling. Rather, the domain of pre-planning for our young Wenzhou speakers seems to be an intermediate level of phrasing and sensitive to syntactic constituency, within which the relative height of sandhi tones varies according to the length of the domain.

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German Intonation Phrases and the Phonology-Syntax Interface

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In this talk I argue for the presence of recursively organized intonation phrases (IPs) in German. Experimental data shows that sentences with complex clause configurations lead to F0 register effects that indicate recursive IP structures reflecting the syntactic branching. This suggests that – contrary to the *Strict Layer Hypothesis* – recursion might be a general principle of prosodic structure that derives from the syntax-prosody mapping. I offer an OT analysis that incorporates aspects of the Ito & Mester (2006) model of prosodic projection and a modification of Truckenbrodt's (2005) analysis on intonational phrasing.

Based on the study by Féry & Truckenbrodt (2005) a production experiment with the clause configurations shown in (1) was conducted.

(1) a. [SUBJ [RC] PRED] and [SUBJ PRED]
$((\quad)_{IP1}\ (\quad)_{IP2})_{IPx}\quad (\quad)_{IP3}$ IP-structure
b. [SUBJ PRED] and [SUBJ [RC] PRED]
$(\quad)_{IP1}\quad ((\quad)_{IP2}\ (\quad)_{IP3})_{IPx}$ IP-structure
c. [SUBJ PRED] and [SUBJ PRED] and [SUBJ PRED]
$(\quad)_{IP1}\quad (\quad)_{IP2}\quad (\quad)_{IP3}$ IP-structure

Two conditions consisting of two conjoined root clauses, with one having a relative clause modifying the subject, were elicited ((1a) and (1b)) and compared to a baseline condition (1c). As the right edges of CPs trigger IP boundaries in German (Truckenbrodt 2005), the stimuli are expected to trigger (at least) three right IP boundaries.

An analysis of global F0 contours revealed that the phonetic reference lines associated with the IPs are lowered according to the syntactic structure. The condition illustrated in (1a) shows reference line lowering from the first to the second IP, but not from the second to the third one. Instead, the reference line of the third IP is partially reset, which is analyzed as lowering in relation to the reference line of the initial IP. Furthermore, some speakers realize an upstep of the nuclear pitch accent of IP_2 that targets the reference line of IP_1. This suggests the presence of a higher IP_X that includes IP_1 and IP_2. In contrast, the condition in (1b) shows reference line lowering from IP_1 to IP_2 and from IP_2 to IP_3, the amount of lowering being significantly greater from IP_2 to IP_3. Since this follows the principle *The Deeper The Steeper* (Féry & Truckenbrodt 2005), I assume the presence of a higher IP_X containing IP_2 and IP_3. The baseline condition (1c) shows a gradual lowering of the IP reference lines from left to right and is thus analyzed as having a flat IP structure.

Based on these findings I show that the constraint Align(CP, R; I, R) (Truckenbrodt 2005) (2) alone is not sufficient to account for German IP structure. I propose to incorporate the constraint Align-L-R (Root, IP) (reminiscent of Match constraints (Selkirk 2009)) and argue that both Alignment and Match-type constraints are needed in order to account for the prosodic structure of German. Tableau 1 illustrates how the two constraints account for the Syntax-Prosody mapping of the clause configuration given in (1a).

(2) Align(CP, R; I, R) (Truckenbrodt 2005)
'The right edge of a CP must coincide with the right edge of an intonation phrase'
(here referred to as Align-R (CP, IP))

(3) Align-L-R (Root, IP)
'The left and right edge of a constituent with root clause status must coincide with the left and right edge of a single intonation phrase'

Tableau 1.

	[[ ]] [ ]	Align-R (CP, IP)	Align-L-R (Root, IP)
a. →	(( )( )) ( )		
b.	( )( ) ( )		*!
c.	( ) ( )	*!	

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On the weak vocalic position in Nivkh

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Languages usually limit the maximal inventory of vocalic contrasts to prosodically prominent positions. One such language is Nivkh, which permits each of the vowels /i ɨ u e o a/ in stressed syllables, but imposes various kinds of restrictions on vowels in unstressed syllables. We focus on this asymmetry by examining the distribution of vowels in Nivkh disyllabic roots.

Nivkh (formerly Gilyak) is a linguistic isolate spoken by approximately 100 speakers on the island of Sakhalin and on the lower reaches of the Amur river, in the Russian Far East. Our data have been drawn from the *Sound Materials of the Nivkh Language* (Shiraishi & Lok 2002–2009), a project which aims to record and publish Nivkh language data. The recordings were transcribed with the aid of a native speaker and then translated into Russian, English, and Japanese. The texts (.pdf) and audio files (.wav) are available on the Internet. So far, about seven hours of recordings have been published, containing daily conversations and recitations of folktales and songs. The *Sound Materials* provide a valuable source for the study of Nivkh phonology.

Earlier sources on Nivkh do not report any asymmetries in the distribution of vowels in disyllabic roots. However, the data in the *Sound Materials* (taken from the dialect of West Sakhalin) reveal that as compared to the stressed V1 position, where all vowels are permitted, the unstressed V2 position is subject to a number of phonotactic restrictions. The table in (1) lists, for each possible combination of vowels, the number of attested tokens in our database (containing a total of 305 disyllabic roots):

(1)

V1 \ V2	i	u	ɨ	e	o	a	
i	7	5	7	1	0	4	24
u	12	10	3	1	1	0	27
ɨ	17	9	33	0	1	1	61
e	7	5	0	3	1	15	31
o	9	12	0	3	19	17	60
a	17	25	2	1	7	50	102
	69	66	45	9	29	87	305

Table 1: number of vowel tokens in V1 and V2 position in Nivkh disyllabic roots

We observe that (*i*) most occurrences of /ɨ/ and /o/ in V2 occur with an identical vowel in V1; (*ii*) /e/ is marginal in V2; and (*iii*) sequences of /i ɨ u/ (in V1) and /a/ (in V2) are rare (each of these patterns is statistically significant). In addition, we note that the observed patterns are not just static restrictions but are also active in the accommodation of loanwords (e.g. *eʁa* 'cow' < Tungusic *iχa*, *sinduχ* 'barrel' < Ainu *sintoko*).

We suggest that the distributional restrictions on the V2 position are due to two cross-linguistically observed asymmetries. First, the restriction on /ɨ e o/ in V2 reflects the tendency to avoid non-corner vowels in the weak position of a foot (e.g. Crosswhite 2004; Harris 2005). Second, the restriction on /a/ in V2 reflects the antagonistic relation between sonority and (the lack of) stress. In some languages, e.g. Takia and Kobon, foot structure is sensitive to sonority, in such a way that the strong position is aligned with the most sonorous vowel (e.g. Kenstowicz 1996; de Lacy 2007). In Nivkh, on the other hand, the maximally sonorous vowel /a/ is, under certain conditions, avoided in the weak position of the foot. Additional support for this comes from the observation that unstressed instances of /a/ are typically reduced to schwa (see Shiraishi 2010).

Our analysis of the Nivkh restrictions takes as its point of departure an AIU model of vowel place. In the standard conception of this model (as outlined in e.g. Harris 2004, 2007), corner vowels are represented as simplex (/i/ = |I|, u = |U|, a = |A|) and non-corner vowels as complex (/ɨ / = |I,U|, /e/ = |I,A|, o = |U,A|). The restriction on non-corner vowels in V2 can then be given a principled explanation in terms of the inability of weak positions to 'license' complex structures (Harris 1997), unless the vowel in V1 acts as 'licensor'. For example, the second /ɨ/ in /ɨtɨk/ 'father' is sanctioned, because its |I| and |U| elements are licensed by the |I| and |U| of the preceding vowel. Similarly, the /ɨ/ in /kitɨ/ 'harpoon' is allowed since its |I| element is licensed by that of the preceding vowel, leaving only a single, unlicensed |U|. Hence, we appear to have the generalization in (2):

(2) Any complex V2 must be at least partly licensed by V1 (e.g. /ɨtɨk/, /kitɨ/, but */itok/)

The restriction on /a/ involves a ban on roots in which /a/ in V2 is preceded by a high vowel in V1, suggesting the generalization in (3):

(3) Any /a/ (i.e. |A|) in V2 must be licensed by an |A| in V1 (e.g. /oʁla/ 'child', but */iʁla/)

This restriction presents more of a challenge, provided we want to do more than stipulate that all things being equal, |A| is disfavoured in weak positions. Following Pöchtrager & Kaye (2011), we will explore an alternative view, viz. one in which 'lowness' is not represented in terms of an element but rather as a structural property. More specifically, we will suggest that /a/ is structurally complex as compared to /i/ and /u/, and that this makes /a/ unfit to occur in unstressed syllables. The advantage of this approach is that it permits a unified account of (2) and (3), in terms of a general restriction on complexity in the weak position of the foot.

Phonetics-phonology interplay in moraic theory:
Evidence from Finnish dialectal gemination

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Finnish is a language in which vowels are contrastive for length in all positions, and consonants can be contrastively geminated intervocalically. This is the case regardless of primary stress, which invariably falls on the first syllable. Additionally, a number of dialects have a phonological process known as "primary gemination" whereby a singleton consonant is geminated between a stressed short vowel and an unstressed long vowel:

		UR	"Standard"	Geminating Dialect
(1)	'word'	/sana/	*sá.na*	*sá.na*
	'word' (partitive case)	/sana-a/	*sá.naa*	*sán.naa*

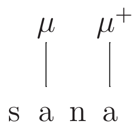
Additionally, a number of dialects show regular second mora lengthening (SML) whereby the second mora of a word is lengthened provided it is voiced (Suomi and Ylitalo 2004). A common way this manifests itself is in what is traditionally referred to as the "half-long vowel", such that the second (unstressed) short vowel of a CV́CV word is actually phonetically longer than the first (stressed) short vowel. Numerous phonetic studies have shown this to be the case in different dialects of Finnish, including Wiik and Lehiste (1968), Suomi and Ylitalo (2004), and Ylitalo (2009), among others.

By comparing data from phonetic studies of the half-long vowel (e.g. Wiik and Lehiste 1968) and dialect surveys of primary gemination (e.g. Kettunen 1940), a correlation can be shown between dialects with the half-long vowel and those with primary gemination.

A previous account pointing out this correlation, Nahkola (1987:25), does not make a connection between primary gemination and SML as a synchronic process. Instead, the unstressed long vowel in *sánaa* is said to originate due to elision, from a historical **sána-ða*. An *overlong* vowel is created due to the combination of a half-long vowel and a short vowel after elision. Primary gemination is said to have occurred in order to compensate for the durational imbalance between the newly created unstressed overlong vowel and stressed short vowel, as in (2). Nahkola notes that this analysis only works provided that the half-long vowel appears historically *before* elision takes place, as in (2); if elision occurred first, then only a long vowel would be created in the second syllable, by combining only two short vowels, and there would be no overlength for which to compensate.

(2)		**sána-ða*
	Half-Long Vowel	*sánaˑða*
	Elision	*sánaˑa*
	Primary Gemination	*sánnaa*

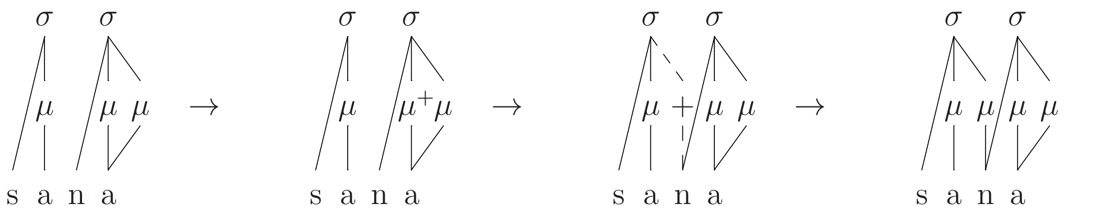
(3)



Contrary to Nahkola, I argue that the overlong vowel synchronically produced as a result of SML is still actively the cause of primary gemination. If SML is applied to a CV́CV word, the result is a half-long vowel in the second syllable. The superscript "+" in (3) above denotes non-phonological length being applied to the mora. Although this process creates phonetic length tending towards a long vowel, this vowel is still phonologically short. However, in the case of a CV́CVV word, the unstressed vowel is already phonologically bimoraic. When SML is applied to such a word, the result is an unstressed vowel bearing more than two full moras, tending perceptually beyond a long vowel.

Although the language could handle this by producing a third phonological category of quantity (overlong), consonants in the language already possess a quantity distinction. There is phonological space to host the weight contributed by overlength on the consonant serving as the syllable's onset. Thus, the additional weight contributed by SML "spills over" onto the onset of the syllable, where it creates a geminate:

(4) a. UR b. SML c. "Spillover" d. Gemination



Thus this model shows an example of phonetics-phonology interplay, in that a phonetic process results in the creation of a phonological geminate, motivated by perceptual factors in the phonetics-phonology interface; there is a limit to how much length can be borne by a single unstressed nucleus, such that a lengthened short vowel is acceptable, but a lengthened long vowel is excessive. SML applies at intermediate representations, referencing both sides of the interface. "Spill-over" allows a phonological outlet for this excess of phonetic length on an adjacent melody.

It is also advantageous in that it allows for an account of the diachronically gradient rise of the gemination process. Paunonen (1973) has said that primary gemination originated as a phonetic lengthening of the intervocalic consonant. This phonetically lengthened consonant is then reanalyzed as being equivalent to full phonemic geminates by subsequent generations of learners (Paunonen 1973). Because the exact amount of additional length and weight attributed by SML can be varied, grammars can be posited in which the process in (4c) has arisen, showing phonetic lengthening, but in which (4d) has not yet become fully established.

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Phonetically unnatural alternation as a result of regular sound change: the case of rounding harmony in Hungarian

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Hungarian vowel harmony is a well described phenomenon (see Ringen and Vago 1998, Siptár and Törkenczy 2000 for a summary), which is based on both frontness and rounding features. This paper is concerned with rounding harmony in particular, and its place in the discussion of universal properties of rounding harmony. I will argue that this phenomenon in Hungarian does not fit in the most widely employed typology of rounding harmony, but Old Hungarian did fit in perfectly. I will show that a regular chain shift of vowels that happened between Old Hungarian and the contemporary language can be held responsible for the phonetically non-natural character of rounding harmony.

Kaun (2004) gives an Optimality Theory analysis of rounding harmony with a set of phonetically grounded constraints that provides a factorial typology. These constraints are based on five conditions that favor rounding harmony: non-high triggers, front triggers, high targets, back targets and triggers and targets agreeing in height. There are 255 possible rounding assimilation types if it can be restricted whether the trigger is high or nonhigh, front or back, the target is high or nonhigh. Of these possible languages, the factorial typology of Kaun's constraints generates only 36: 13 of which are attested in her survey. No language in her survey falls outside this typology – but Hungarian does.

There are two conditions for Hungarian which are not included in the conditions of Kaun: the target must be short and mid, as the only alternation obeying rounding harmony is the /o∼ɛ∼ø/ allophony in suffixes. The incorporation of the first condition does not seem to pose a problem, but the condition that the target vowel is mid, so non-high, actually contradicts Kaun's condition that the phonetically 'optimal' target is high and the corresponding *RoLo constraint. To account for Hungarian, two more constraints should be added to the typology: *RoHi and *RoLong, but these constraints would go against the phonetic grounding presented in Kaun (2004), and the number of typologically possible languages would grow exponentially.

The solution for this problem (as in Polgárdi and Rebrus (1998) and Ringen and Vago (1998)) has been the proposal that Hungarian *does not even have* rounding harmony, but it employs a licencing constraint. The front rounded mid short vowel /ø/ is not licenced after front unrounded vowels, therefore suffixes with [o∼ø] alternations must employ the front unrounded [ɛ] allophone after front unrounded triggers. This analysis lacks the phonetic grounding of Kaun (2004), however, and introduces the possibility to analyze vowel harmony systems in other languages with licencing constraints, with unwanted typological conseqences again.

A remarkable point about this phenomenon, however, is that rounding harmony was present in Old Hungarian, as seen in the earliest codices of the 10th-11th century (see E. Abaffy 2004b), and its properties fit in Kaun's typology perfectly: only high targets underwent rounding harmony. An example can be seen below showing the Old Hungarian nominative suffix, which consisted of a reduced high vowel, that has been lost in the 12th century:

(1) Old Hungarian word final harmonizing reduced vowels (each gloss is a tribe name)

	Old Hungarian	Modern Hungarian
front rounded	kyrt**y̆**	kyrt
front unrounded	meʤer**ĭ**	mɛɟɛr
back	ʤermat**ŭ**	ɟɒrmɒt

A chain shift of vowels happened between the 12th-14th centuries (E. Abaffy 2004a), consisting of lowering and rounding of most vowels. The mid front rounded /ø/ phoneme was not even found in Old Hungarian: it developed from the lowering of /y/ and the rounding of /e/ (which can be the result of the lowering of /i/ as well). This chain shift resulted in a situation, where most of the targets of rounding harmony in suffixes (ie. /u∼i∼y/) either lost rounding harmony, or lowered to /o∼ɛ∼ø/.

If Kaun's typology really represents the innate grammar's handling of rounding harmony, then this vowel shift would be expected to have one of the following two effects: rounding harmony either disappears in the language, because it creates an impossible grammar, or it is preserved for suffixes that did not obey lowering, and lost for those that did get lowered. The history of Hungarian shows a third case: rounding harmony was transferred to the lowered mid series, and lost for those, which remained high (like the third person plural possessive /uk/∼/yk/ suffix). This problem can be explained in Optimality Theory terms, like as seen in the analysis of Ringen and Vago (1998) above as the loss of rounding harmony (reranking of ALIGN[ROUND] below faithfulness) and the introduction of a licencing constraint (eg. LINK[ROUND]) for /ø/, but this does not seem to grab the true insight to what really happened in the language, and how speakers' grammars might have changed.

Rounding harmony in contemporary Hungarian questions the universality of phonetically grounded constraints proposed for this particular phenomenon, but language change points out, that these constraints have had a role in the development of the current pattern. This study might supply arguments for an approach, where the typology defined by these constraints (and the Optimal Theoretical approach behind it) should not necessarily be discarded, but languages falling outside this typology should be allowed, as regular sound changes can create phonetically non-natural processes, which cannot be described using the constraint set used for the universal phenomenon (see Blevins 2004).

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Compensatory Lengthening and Opaque Gemination in Harmonic Serialism

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This paper explores two related phonological processes involving mora preservation, compensatory lengthening in East Ionic Greek (Steriade 1982, Wetzels 1986, Hock 1986, Hayes 1989), Komi (Shaw 2009), and opaque gemination in West Germanic (Bermúdez-Otero 2001). Both compensatory lengthening and West Germanic gemination are cases of counter-bleeding opacity in which weight by position over-applies. I propose that Harmonic Serialism, as opposed to parallel Optimality Theory, derives compensatory lengthening only if (i) syllabification is subject to the gradualness requirement on GEN and thus cannot co-occur with other phonological operations (Elfner 2009, Pater 2011), and (ii) deletion of a coda consonant is a two-step process that begins with debuccalisation and is followed by deletion of the root node (McCarthy 2008). Apart from gradual syllabification, directionality is needed to account for opaque West Germanic gemination.

When GEN operations are able to be decomposable into more primitive operations, counter-bleeding opacity can be accounted for in Harmonic Serialism (McCarthy 2007). The theories of gradual syllabification and deletion as a two-step process confer on Harmonic Serialism a myopic nature. It cannot 'look ahead' to the global minimum of harmonic improvement, which would correspond to the candidates with deletion but no lengthening.

Compensatory lengthening in Komi is caused by deletion of a mora-bearing coda consonant /l/. In East Ionic Greek it is caused by re-syllabification of a weight-contributing coda consonant to onset position triggered by /w/ deletion. As illustrated in the Harmonic Serialism derivation in tableau 2, at step 1 deletion of the weighted coda is not a possible GEN operation under the hypothesis that deletion must be preceded by debuccalisation (compare candidate [c] and candidate [a]). This way, opacity is evaded because the transparent candidate, with deletion but no lengthening, cannot be generated. Instead, the winning candidate at step 1 is the candidate in which the lateral is adjoined into the already existing syllable. Debuccalisation and deletion applies at step 2 and 3, giving rise to compensatory lengthening at step 5.

In West Germanic, pre-/j/ gemination applies before all consonants, except for the more sonorous /r/ (/bid-I-an/ → [$(bi_\mu d_\mu)(dja_\mu n_\mu)$]). In Stratal Optimality Theory (Bermúdez-Otero 2001), a lexical constraint hierarchy *[$_\sigma$Cj » SYLLABLE-CONTACT is needed to account for the intermediate form in which weight by position is satisfied ([$(bi_\mu d_\mu)(ja_\mu n_\mu)$]). Re-ranking of the constraints at the post-lexical level (SYLLABLE-CONTACT » *[$_\sigma$Cj) is responsible for selecting the opaque candidate with gemination. However, in Harmonic Serialism the constraint hierarchy is perdurable. I argue in favor of a left-to-right directional syllabification algorithm for West Germanic triggered by the satisfaction of the alignment constraint ALIGN-Left(σ, ProsodicWord). This alignment constraint assigns one violation mark for every unparsed segment that stands between the left edge of every syllable and some prosodic word. The Harmonic Serialism derivation proceeds as follows: (bi_μ)dIan, $(bi_\mu d_\mu)$Ian, $(bi_\mu d_\mu)(ja_\mu)$n, $(bi_\mu d_\mu)(ja_\mu n_\mu)$. Hereby, the form $(bi_\mu)(dja_\mu n_\mu)$ is not selected as an intermediate winning candidate, although it satisfies SYLLABLE-CONTACT. This situation allows *[$_\sigma$Cj to be dominated by SYLLABLE-CONTACT, then solving the apparent ranking paradox.

Appendix:

(1) (a) East Ionic Greek compensatory lengthening in parallel Optimality Theory

	/$o_\mu dwo_\mu s$/ 'threshold'	*[w]	ONSET	DEP-μ	MAX-C
a. 💣	$(o_\mu)(do_\mu s_\mu)$		1	1 L	1
b. ☹	$(o_{\mu\mu})(do_\mu s_\mu)$		1	2	1
c.	$(o_\mu d_\mu)(o_\mu s_\mu)$		2 W	2	1
d.	$(o_\mu d_\mu)(wo_\mu s_\mu)$	1 W	1	2	L

(b) Komi compensatory lengthening in parallel Optimality Theory

	/kɨ$_{\mu}$l-nɨ$_{\mu}$/ ‘hear.INF’	WEIGHT-BY-POSITION	CODA-COND([l])	DEP-μ	MAX-C
a. 💣	(kɨ$_{\mu}$)(nɨ$_{\mu}$)			L	1
b. ☹	(kɨ$_{\mu\mu}$)(nɨ$_{\mu}$)			1	1
c.	(kɨ$_{\mu}$l$_{\mu}$)(nɨ$_{\mu}$)		1 W	1	L
d.	(kɨ$_{\mu}$l)(nɨ$_{\mu}$)	1 W	1 W	L	L

(c) West Germanic gemination in parallel Optimality Theory

	/bi$_{\mu}$d-I-a$_{\mu}$n/ ‘ask.INF’	ONSET	SYLLABLE-CONTACT	*[$_{\sigma}$Cj	DEP-μ
a. 💣	(bi$_{\mu}$)(dja$_{\mu}$n$_{\mu}$)			1	1 L
b. ☹	(bi$_{\mu}$d$_{\mu}$)(dja$_{\mu}$n$_{\mu}$)			1	2
c.	(bi$_{\mu}$d$_{\mu}$)(ja$_{\mu}$n$_{\mu}$)		1 W	L	2
d.	(bi$_{\mu}$)(di$_{\mu}$)(a$_{\mu}$n$_{\mu}$)	1 W		L	2

(2) Komi compensatory lengthening in Harmonic Serialism

Step 1	/kɨ$_{\mu}$l-nɨ$_{\mu}$/	WEIGHT-BY-POSITION	PARSE-SEG	MAX-μ	DEP-μ	CODA-COND ([l])	MAX-[place]	HAVE-PLACE	MAX-C	*FLOAT-μ	DEP-LINK-μ
a. →	(kɨ$_{\mu}$l$_{\mu}$)(nɨ$_{\mu}$)				1	1					1
b.	(kɨμl)(nɨ$_{\mu}$)	1 W			L	1					1
c.	kɨ$_{\mu}$Lnɨ$_{\mu}$		5 W		L	L	1 W	1 W			L
Step 2	/(kɨ$_{\mu}$l$_{\mu}$)(nɨ$_{\mu}$)/										
a. →	(kɨ$_{\mu}$L$_{\mu}$)(nɨ$_{\mu}$)						1	1			
b.	(kɨ$_{\mu}$l$_{\mu}$)(nɨ$_{\mu}$)					1 W	L	L			
Step 3	/(kɨ$_{\mu}$L$_{\mu}$)(nɨ$_{\mu}$)/										
a. →	(kɨ$_{\mu}^{\mu}$)(nɨ$_{\mu}$)								1	1	
b.	(kɨ$_{\mu}$L$_{\mu}$)(nɨ$_{\mu}$)							1 W	L	L	
Step 4	/(kɨ$_{\mu}^{\mu}$)(nɨ$_{\mu}$)/										
a. →	(kɨ$_{\mu\mu}$)(nɨ$_{\mu}$)										1
b.	(kɨ$_{\mu}^{\mu}$)(nɨ$_{\mu}$)									1 W	L
Step 5	/(kɨ$_{\mu\mu}$)(nɨ$_{\mu}$)/										
a. →	(kɨ$_{\mu\mu}$)(nɨ$_{\mu}$)										
b.	(kɨ$_{\mu}$)(nɨ$_{\mu}$)			1 W							

Notation: superspcrit <$^{\mu}$> stands for a floating mora and capital <L> for a debuccalised lateral.

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Serial versus parallel modelling of L2 perceptual and lexical development

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The learner of a second language (L2) is faced with various kinds of problems: phonetic, phonological, lexical and many others. One example of a *phonological* problem is that the L2 may have more phonemes along a given phonetic continuum than the L1; or conversely, it may have less. In the Second Language Linguistic Perception model of Escudero (2005), the first situation is called the NEW scenario, the latter the SUBSET scenario. One example of a SUBSET scenario is when a native speaker of Dutch learns Spanish: Dutch has the front vowels /i/, /ɪ/ and /ɛ/ in the acoustic space where Spanish has only /i/ and /e/.

Escudero (2005) gives an Optimality Theoretic account of the SUBSET scenario, cast in the framework of Stochastic OT with the Gradual Learning Algorithm (Boersma 1998). In this model, a virtual learner is equipped with a two-stage grammar. The input to the first *perceptual* grammar is a phonetic form which is mapped to a vowel phoneme according to the ranking of several *cue constraints* (Boersma 2009); these cue constraints are formulated as “do not map a stimulus with value [x] to phoneme /y/”. The winning candidate in the perceptual grammar then serves as input to the *recognition* grammar, where two kinds of constraints operate: faithfulness constraints of the type “do not map phoneme /y/ to the underlying form |z|”; and lexical constraints of the type “do not link underlying form |z| to the morpheme <A>.” (Figure 2)

In Escudero (2005)'s serial account, a Dutch learner's L2 Spanish grammar will initally be identical to her L1 Dutch grammar, suitable for mapping incoming front vowel signals to the corresponding three Dutch vowels and then recognizing words on the basis of these vowels. Crucially, *recognition errors* where one lexical item is mistaken for another (e.g. Spanish [tʃeka] “Czech.F” is mistaken for [tʃika] “girl”) trigger a shift of lexical and faithfulness constraints, to decrease the probability of ocurrance of such errors. If recognition errors are judged to be the result of a *perception error*, then the rankings of the cue constraints are also shifted. The prediction is that this updating process will lead to less and less vowels being perceived as |ɪ|, until the category finally falls out of use and the learner is left with two distinct Spanish-like categories.

Weiand (2007) implemented Escudero's model to test these predictions. However, it turned out that with the model as described above, virtual learners did not converge on a stable two-vowel grammar. We therefore present an alternative account, in which perception and learning is *parallel*, i.e., a *single* OT grammar handles both perception and recognition, where the cue, lexical and faithfulness constraints occupy the same stratum of the grammar, and either type may outrank the other. In other words, there may be feedback from the lexicon to the phonemic level. The existence of such feedback is hotly debated in psycholinguistics (Norris et al. 2000).

Results show that the parallel grammar does converge to a Spanish-like state in the manner predicted by Escudero (2005) and evidenced by empirical results (Boersma and Escudero 2008): the /ɪ/ category gradually diminishes and ultimately disappears in favor of /i/ and /e/ (Fig. 3). Intriguingly, there is an intermediate phase where the learner is already perceiving the Spanish lexical items correctly, but still uses her Dutch /ɪ/ category; /i/ and /ɪ/ serve as allophones of the same underlying |i|. In conclusion, our modelling study sheds light on the role of lexical feedback in (second) language perception and suggests that L1 phonological categories may still be playing a role in perception when L2 recognition performance has attained a (near-)native level.

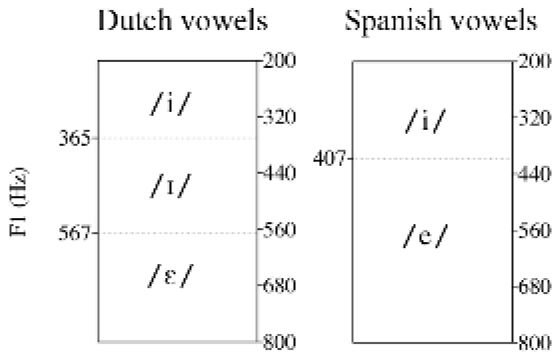

Figure 1: Dutch and Spanish front vowel continua

[F1 = 550 Hz]	[550 Hz] not /i/	[550 Hz] not /ɛ/	[550 Hz] not /ɪ/
/tʃika/	*!		
/tʃɛka/		*!	
☞ /tʃɪka/			*

/tʃɪka/ Intended meaning: 'girl'	FAITH */ɪ/ → |i|	FAITH */ɪ/ → | ɛ|	*LEX |tʃɛka| 'Czech'	*LEX |tʃɪka| 'girl'	*LEX |tʃika| 'girl'	*LEX |tʃɪka| 'Czech'
✓ |tʃika| 'girl'	*!				*	
|tʃɛka| 'Czech'		*!	*			
✓ |tʃɪka| 'girl'				*!		
☞|tʃɪka| 'Czech'						*

Figure 2: Example perception and recognition tableaus in a serial grammar.

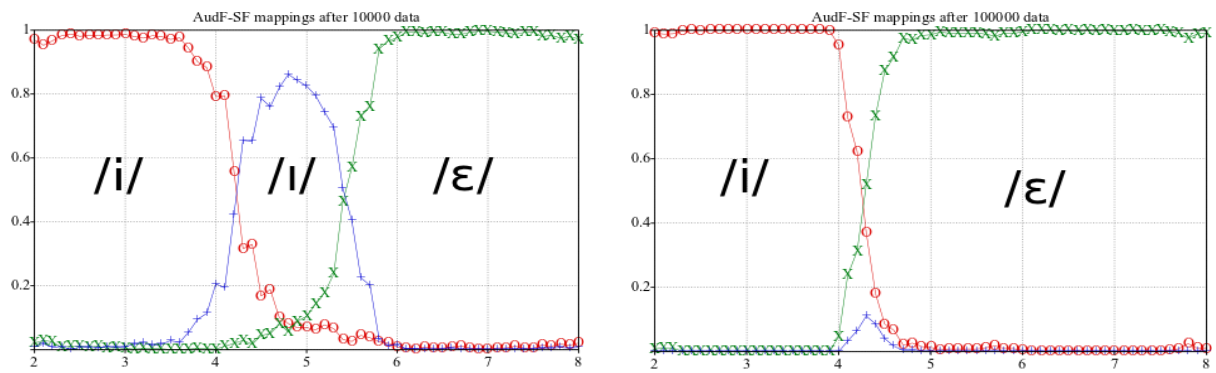

Figure 3: Vowel perception as a function of F1 input. A virtual L2 Spanish learner equipped with a parallel grammar has her /I/ category diminished, then subsumed over the course of learning.

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Being frequent as a way of growing old

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Against arguments to the contrary, we argue that phonological theory has sufficient means to succesfully describe the process of lexical diffusion, including frequency effects. It therefore is not necessary to abandon well-established frameworks of formal phonology or introduce alien elements into the theory such as frequency counts.

1. Background The distinction between lexical diffusion and Neogrammarian (exceptionless) sound change, operating at the level of the phoneme, has never been off the research agenda since Labov (1981) claimed to have resolved the issue by giving each of them a separate place in the theory of language change. In the past decade, the topic has played a role in debates between so-called usage-based and so-called rule-based phonologists. In particular, it has been argued (Bybee 2001, 2002) that lexical diffusion itself is problematic for a grammatical theory (see Labov (2010) for relevant discussion). If grammatical processes can be switched on or off on a word-by-word basis, and if furthermore factors such as word frequency play a role in determining the chances that the word will undergo the change or not, we seem to have an argument in favour of exemplar-based views on the organisation of language rather than for a grammar-based view, because it suggests that languages can have 'a little bit' of a phonological process.

2. Claim In spite of the problem just mentioned, we argue that a straightforward interpretation of lexical diffusion in grammatical terms is possible. A related claim was made by Kiparsky (2003), who proposed that "lexical diffusion is the analogical generalization of lexical phonological rules". Our proposal is however more radical: no special mechanisms are necessary to understand the process of lexical diffusion than a more refined view of Lexicon Optimisation and language acquisition.

3. Empirical basis We discuss three phenomena which are relevant for this: the gradual development of a final devoicing process in Frisian in the course of the 19th Century; the loss of umlaut within an area of Dutch and German dialects; and the intervocalic s voicing in several dialects of Italian. The first phenomenon plays an important role in the discussion of language change in Blevins (2004). Until the early 19th centory, Frisian was the only continental West Germanic language without final devoicing, different from its neighbours German and Dutch. At present, all dialects have virtually exceptionless final devoicing – the way in which this process arose has been documented quite extensively, and from this we can see that lexical diffusion played a role, while at the same time phonological context was also important. The loss of umlaut in German and Dutch dialects is interesting because it can be studied geographically: as we move along certain dimensions of the map, we can see how the process becomes more and more lexicalized, and displaying more and more exceptions. It is not clear that any single stage would represent the transition from purely phonological to purely morphological. *s* voicing in Italian is similarly well-studied, but we show that there is an extra dimension to the problem which has hitherthough not been taken into account: also other obstruents voice in intervocalic position to a smaller or larger extent. We argue that taking *s* voicing on its own is thus an arteficial way of cutting out an 'exceptionless' process from a rather more gradient world.

4. Analysis We argue that these data do not just fail to provide evidence in favour of a exemplar-based view of language and language change, but as a matter of fact can be elegantly described in a view based on grammar and grammatical learning. We implement the idea in a classical version of Optimality Theory, changing slightly the process of Lexicon Optimization to deal with learning under noisy conditions. In particular, we propose the following definition:

(1) *Selective Lexicon Optimisation:* In case of conflicting evidence, choose the underlying representation with the lowest violation profile

We propose that the noise provides the language learner in some cases with indeterminacy as to the intended form. E.g. , in the case of 19th Century Frisian, both real phonetic noise and Dutch-Frisian or German-Frisian bilingualism, learners might have become uncertain whether e.g. [huːz] or [huːs] was said (for 'house'). Given this uncertainty, they might have gone for the latter, since that would satisfy the FinalDevoicing constraint (ranked very low at that point in the grammar of Frisian) as well as all the faithfulness constraints. The latter is true by definition, since the learner does not yet know what the underlying form is supposed to be either. Lexicon Optimization would to be further refined to be able to deal with alternations, along the lines of Inkelas (1995). In this way, a grammatically governed process may spread in the lexicon on a word-by-word basis. At some point, all words (or a substantial proportion) will show the alternations typical of final devoicing. At that point, a new generation of learners may decide to keep FinalDevoicing in its original, high position in the constraint hierarchy. At that point devoicing will have become a productive grammatical process. Similar stories can be shown to hold for the loss of umlaut and for voicing of *s* and other obstruents. What about the role of frequency? It is obviously the case that on the one hand the more often a word is used, the more likely it will be that phonetic and other noise will affect it. Words which have been in the language for a long time therefore are more likely to have been affected by the change. At the same time, more frequent words age more quickly under this scenario: they are under constant exposure to the noise accompanying language contact and phonetic implementation. None of this means we have to abandon grammatical theory, or even introduce numbers into the theory directly: the numbers are the result of the interaction of categorical grammar with a noisy environment.

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The structure of English syllables with postvocalic /ɹ/: An articulatory view

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In rimes of English with postvocalic /ɹ/, issues involving restrictions on vowels and speaker intuitions about syllabicity have given rise to debate about the weight-contributing status and organization of /ɹ/. This paper reports on an articulatory study of /ɹ/, finding that aspects of its production bring critical insight to the structure and phonotactics of rimes with /ɹ/.

BACKGROUND. The weight-contributing status of postvocalic /ɹ/ in General American English (GAE) has received contradictory treatments. Several analysts concur that word-final GAE rimes usually make available up to three positions or units, which may be occupied by a diphthong or long (tense) vowel plus a single consonant (e.g. *pike* [paɪk], *peak* [pik]) or by a short (lax) vowel plus two consonants (e.g. *hasp* [hæsp], *milk* [mɪlk], **heesp* [hisp], **sawlk* [sɔlk]) (Fujimura 1979, Borowsky 1986, Hammond 1999). This structure excludes a possible extrametrical appendix of coronal obstruents (e.g. *texts* [tɛksts]) (e.g. Fujimura 1979, Kiparsky 1980). However, in GAE, /ɹ/ plus a noncoronal consonant occurs only following tense nonhigh back vowels [ɑ, ɔ], e.g. *harp* [hɑɹp], *pork* [pɔɹk], which appears to exceed the rime size limit. The tense, long status of these vowels is diagnosed by their ability to occur in vowel-final monosyllabic words (*spa* [spɑ], *law* [lɔ]). To accommodate these forms with /ɹ/, Hammond (1999), proposes (a) that syllables in English have a maximum of three moras, and (b) postvocalic /ɹ/ is not assigned a mora. Words like *boar* [bɔɹ] and *fire* [faɪɹ] are resultingly assigned two moras (for the long vowel or diphthong), and words like *oak* [ok], *fight* [faɪt], and *pork* [pɔɹk] are assigned three (for the long vowel or diphthong plus final stop).

The nonmoraic analysis of /ɹ/ meets with two difficulties. First, there is no evidence in the stress pattern of GAE to support analyzing syllables with postvocalic /ɹ/ as lighter than other closed syllables. Second, many speakers rate “syllables” with a diphthong plus /ɹ/ (*fire, hour*) as amounting to 1.5 or 2 syllables (Lavoie & Cohn 1999). This runs counter to the treatment of *fire* as lighter than *oak*; in fact, Lavoie & Cohn analyze *fire* as a trimoraic ‘sesquisyllable’, while regular closed syllables of English, like *oak*, have just two moras. Yet if coda /ɹ/ contributes a mora, its cooccurrence with tense vowels is not predicted by moraic structure.

PHONETIC STUDY. We suggest that the special behavior of English /ɹ/ derives from the vowel-like dorsal constriction that it presents in addition to its coronal constriction (Delattre & Freeman 1968, Zawadzki & Kuehn 1980). We pursue the hypothesis that it is not the tense/lax (nor long/short) property of the vowel before /ɹ/ that is relevant but rather the degree of coincidence of the posture of the tongue dorsum during the vowel and /ɹ/. The tongue dorsum is significant in these sequences, because it is a shared articulator for the vowel and /ɹ/, whose gestures are expected to show some overlap. Also, the tongue dorsum tends to move slower than the tongue tip, with longer transitions (Kuehn & Moll 1976), so the dorsal gesture of /ɹ/ is expected to overlap with the vowel more than its coronal gesture.

We conducted an articulatory study of /ɹ/ with three speakers of GAE using real-time structural Magnetic Resonance Imaging (MRI). The technique captures images of the mid-sagittal plane of the vocal tract at 33 frames/sec. Subjects produced /ɹ/ in simple and complex codas in a range of vocalic environments. Results reveal that in the transition from a vowel into /ɹ/, the tongue dorsum shows the least movement in [-ɑɹ-]$_\sigma$ and [-ɔɹ-]$_\sigma$ sequences (Fig. 1). Using air-tissue outlines extracted from the MRI data, panels in Fig. 1 superimpose midsagittal tongue positions captured at successive 30 ms intervals. The lightest line shows the mid-vocalic tongue position and the darkest the mid-consonantal position. The sequence of tongue positions for [-iɹ]$_\sigma$ shows considerable difference in the tongue dorsum posture for the vowel vs. /ɹ/. However, the sequences for [-ɔɹ]$_\sigma$ and [-ɑɹ]$_\sigma$ show almost no change in dorsal posture.

The dorsal stability in [-ɔɹ] and [-ɑɹ] sequences brings insight as to why these are the only full vowels before a complex coda with /ɹ/. Because their dorsal articulatory postures most closely resemble the intrinsic dorsal posture of the following rhotic, [ɔ] and [ɑ] have the greatest capacity to overlap with /ɹ/, and therefore represent the most felicitous nuclear segments before coda rhotics in English.

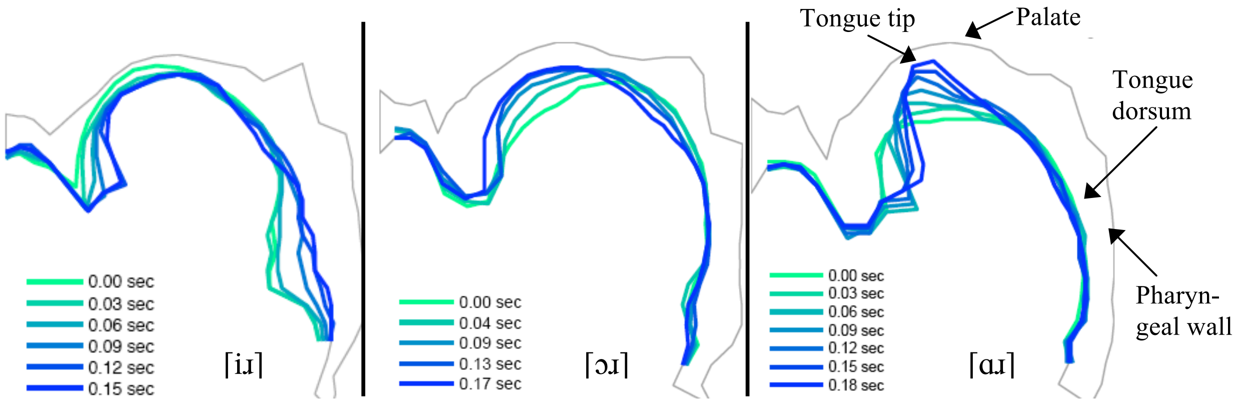

Figure 1. Sample productions of tautosyllabic vowel-/ɹ/ sequences. Midsagittal tongue position captured at 30 ms intervals. Left panel: [iɹ]$_{\sigma}$, center: [ɔɹ]$_{\sigma}$, right: [ɑɹ]$_{\sigma}$.

RIME STRUCTURE. Given the similar dorsal posture in [ɑ, ɔ] and /ɹ/, we suggest [ɔɹ] and [ɑɹ] sequences each form a complex phonological unit that is coordinated so that the gestures are partially blended. This unit can share positions in the rime. Thus, diphthongs and tense vowels usually occupy two positions in an English rime (1a), and [ɔɹ] and [ɑɹ] are likewise produced together over two positions (1b), owing to the high degree of overlap in the dorsal gestures of these segments. This representation bears similarities to proposals that postvocalic /ɹ/ can form a diphthong with a preceding vowel in GAE (Harris 1994, Green 2001), but it restricts the structure to particular vowel qualities. In a sequence like [iɹ], there is less overlap, so position sharing is not possible (1c), and a rime sequence like [iɹk] would exceed the three position maximum (1d). We represent terminal positions in the rime here using Xs rather than moras so that regular closed syllables of English could be analyzed as bimoraic, in line with their traditional treatment, and sesquisyllables could be considered trimoraic.

(1) a. X X X b. X X X c. * X X X d. * X X X X
\/ | \/ | \/ | \/ | |
[ɑ] k [ɑɹ] k [iɹ] k i ɹ k

CONCLUSION. This study supports a view of the special properties of rimes with /ɹ/ that takes articulatory overlap into account, rather than being related primarily to vowel tenseness and length distinctions, and it avoids difficulties presented by the nonmoraic analysis of /ɹ/.

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A unified approach to the phonotactics of word edges

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Within Strict CV Phonology there exist two major approaches that aim at explaining the phonotactics of word edges.

Cyran (2010) explains the implicational relationship between the presence of true clusters of rising sonority (TR), which implies the presence of clusters of falling sonority (RT), which in turn implies the presence of simplex onsets (C) within a given system. Although his approach generates the typology of the right margin, it is unable to account for the situation found at the left edge of words.

Scheer (2004, 2006), on the other hand, argues convincingly that there are two patterns found at the beginning of words: i) some languages do not allow RT clusters and ii) some languages allow words to start with all types of combinations of consonants. He explains the existence of these patterns by postulating a parameter by which some languages translate a morpho-syntactic boundary marker into an empty CV at the beginning of words. The fact that the empty CV must be governed accounts for the behaviour of the left-edge clusters. Still, Scheer's approach does not generate the correct typology of the right edge of words.

In this presentation I would like to put forward a CV analysis that generates the correct typology of consonantal clusters at both the left and the right edge of words.

I claim that a theory that deals with the phonotactics of word margins must make following assumptions about the application of Licensing and Government to phonological strings: i) every C position must be licensed by a V; ii) true TR clusters create head-final domains that silence Vs they enclose; iii) Vs enclosed within TR clusters are deprived of lateral potential and are invisible to Government; iv) Vs enclosed within RT clusters are subject to Government from the following Vs; v) various categories of V positions differ in strength.

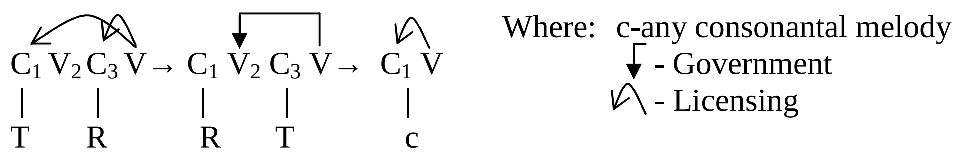
There also exists a universal Locality Constraint on the application of Licensing and Government.

(1) Locality Constraint

A nuclear category N may contract a lateral relation R with a skeletal position P_n iff it may contract the opposite relation with a skeletal position P_{n+1}.

In (1) R stands for Licensing or Government and P for a C or a V position. (1) says, among others, that if a V is capable of licensing a C, it must be able to govern the V to the right of this C. If it is able to govern a V, it must be able to license a C to the right of that V. As a result, an implicational relationship between different structures is generated. This relationship is depicted in (2).

(2)



(2) shows how the presence of TR implies the presence of RTs, which in turn implies the presence of CV syllables and how (1) generates the right-edge pattern. Polish, for example, has final TR clusters, e.g. *wiatr* /vʲatr/ 'wind', RT clusters, e.g. *czart* /t͡ʃart/ 'devil', as well as words ending in single consonants, e.g. *bat* /bat/ 'whip'. English possesses only final RT clusters and simplex consonants, while Spanish allows only simplex onsets to end words.

As to the left-edge patterns, the absence of initial RT clusters in some languages should stem from the inability of governed nuclei to govern. However, there exist cases in which governed nuclei seem to condition the presence of RT clusters. This is visible in alternations like Polish *marchew-marchwi* /marøxɛf/-/marøxøfʲi/ 'carrot, gen. sg.', English *comfort-comfortable* /kʌmøfət/-/kʌmøføtəbəl/ or Saint Etienne French *fortment* /forøtəmɔ̃/~/forøtømɔ̃/ 'strongly'. Cases like these seem to falsify the claim that governed nuclei must not govern. What is more, all three languages show vowel syncope that results in the existence in the initial position of consonant sequences that cannot be treated as TR domains., e.g. Polish *łez-łza* /wɛz/-/wza/ 'tear gen. pl., nom. sg.', English *potato* /pəteɪtəʊ/~/pteɪtəʊ/ or French *secret* /səkrɛ/~/skrɛ/ 'secret'.

In my presentation I would like to suggest a way to solve the problem of governed nuclei that condition RT clusters and offer a new insight into the left-edge phonotactics.

As has been mentioned above, different types of nuclei differ in their lateral potential. It has been shown in Cyran (2010) that the lateral potential of nuclei may be represented on a scale. A revised version of such a scale is presented below.

(3) The scale of nuclear strength

V	FEN	V e	V | e

The strength of nuclei grows towards the head of the arrow. The nuclear categories given in (3) represent empty nuclei, Final Empty Nuclei, nuclei with floating melody and nuclei with melody attached to the skeletal position.

Additionally, let me also postulate the Governor Strength Condition.

(4) The Governor Strength Condition

A nuclear category N may be governed only by a stronger nuclear category.

(3) and (4) allow for the existence of sequences like Polish *marøchøwi* or English *comfortable* /kʌmøføtəbəl/ iff the second governed nucleus is an alternating vowel. In addition to that, (3) and (4) capture the fact that languages that possess the initial CV (e.g. English) may allow the initial clusters other than TRs iff these clusters are the result of a vowel syncope. Languages that do not possess the initial CV may possess initial RT clusters that may or may not enclose alternating vowels (e.g. Polish). (5) presents a revised typology of the left edge.

(5)

only # CV e.g. Hawaii, Zulu	# = CV
only #TR, #CV e.g. Spanish	# = CV
only #TR, #CV, #C(ə)C e.g. English, French	# = CV
#TR, #CV, #C(ə)C, #CC e.g. Polish	# ≠ CV

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Sequences of high tones across word boundaries: downstep and phrasing in Tswana

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Background

This study examines the structural conditions for downstep in Tswana. The term downstep refers to the phonological and/or phonetic lowered realisation of an underlying high tone in a sequence of two adjacent high tones. For the Southern Bantu languages belonging to the Sotho-Tswana cluster (S30) two conflicting views can be found in the literature on the conditioning of downstep across word boundaries. The "phonological approach" (Creissels 1998) postulates a purely tonally conditioned lowered realisation of an underlying high tone for the language Tswana. More precisely, "a downstep automatically occurs whenever a boundary between two adjacent words is immediately preceded by an H-toned syllable and immediately followed by at least two successive H-toned syllables. [...] This downstep occurs irrespective of the precise syntactic nature of the boundary between the two words and of their morphological structure." Examples are provided in (1) from Creissels (1998), where downstep takes place in (1a) and is blocked in (1b) because the condition of the phonological context of three adjacent high tones is not met. High tones are indicated by an acute accent, underlying high tones by underlining, downstep by an exclamation mark.

(1) a. (lìsí̲χɔ́ ꜝʊ̲́-χá̲má qhòːmʊ̲́)φ ; Orthography: Lesego o gama kgomo
PROP.NAME SC1-milk cow
"Lesego milks/is milking the cow"

b. (lìsí̲χɔ́ ʊ̲́-à-χâ̲ːmà)φ; Orthography: Lesego o a gama
PROP.NAME SC1-ASP-milk
"Lesego does/is doing the milking"

In contrast, Khoali (1991) postulates a "phrasal approach" to downstep in Southern Sotho, a variety of the same language group which is mutually intelligible with Tswana. Within the framework of Prosodic Domains (Nespor & Vogel 1987) Khoali (1991) states that in a sequence of two adjacent high tones across word boundaries, a word initial high tone is downstepped if both words occur within a Phonological Phrase. Thus, Khoali would predict downstep on the H tone of the subject concord in (1b), as opposed to Creissels.

Predictions

The two approaches converge on predictions in contexts such as (2a), in which a subject noun (N) with a final high tone is followed by a high-toned subject concord (SC) which itself is followed by a high-toned verb (V). Both approaches would predict downstep to occur before the subject agreement marker. However, the approaches make different predictions for structures like (2b), in which a subject noun (N) with a final high tone is followed by a high-toned subject concord (SC) which itself is followed by a low-toned aspect marker (ASP). The phonological approach would predict no downstep because only two high tones occur adjacently and the phonological condition is therefore not met. The phrasal approach predicts downstep because two adjacent high tones occur across a word boundary within a phonological phrase, parallel to (2a). By contrast, the phrasal approach claims that only an intervening phrase boundary can block downstep, as in the structure in (2c). In (2c), the phonological approach predicts a downstep because of three adjacent high tones across a word boundary. The phrasal approach, however, predicts the blocking of downstep due to the intervening phrase boundary, which Khoali (1991) argues to be induced to the left of a nominal modifier (POSS N).

(2)	Morphological structure	Phonological structure	Prediction Phonological approach	Prediction Phrasal approach
a.	N SC-V...	$((\ldots\underline{\sigma}_{H1})_{\omega}\ (\underline{\sigma}_{H2}\ \underline{\sigma}\ \ldots)_{\omega}\ldots)_{\varphi}$	$\underline{\boldsymbol{\sigma}}\ {}^{!}\underline{\boldsymbol{\sigma}}\ \underline{\sigma}\ \ldots$	$\underline{\boldsymbol{\sigma}}\ {}^{!}\underline{\boldsymbol{\sigma}}\ \underline{\sigma}\ \ldots$
b.	N SC-ASP-V	$((\ldots\underline{\sigma}_{H1})_{\omega}\ (\underline{\sigma}_{H2}\ \sigma\ \underline{\sigma}\ \ldots)_{\omega})_{\varphi}$	$\underline{\boldsymbol{\sigma}}\ \underline{\boldsymbol{\sigma}}\ \sigma\ \ldots$	$\underline{\boldsymbol{\sigma}}\ {}^{!}\underline{\boldsymbol{\sigma}}\ \sigma\ \ldots$
c.	N POSS N SC-V...	$((\ldots\underline{\sigma}_{H1})_{\omega})_{\varphi}\ ((\underline{\sigma}_{H2}\ \underline{\sigma}\ldots)_{\omega}\ldots)_{\varphi}$	$\underline{\boldsymbol{\sigma}}\ {}^{!}\underline{\boldsymbol{\sigma}}\ \underline{\sigma}\ \ldots$	$\underline{\boldsymbol{\sigma}}\ \underline{\boldsymbol{\sigma}}\ \underline{\sigma}\ \ldots$

The study

An empirical study was designed to answer the question if the phonological or the phrasal context is the determining factor for downstep in the variety of Tswana spoken in Huhudi/Vryburg in the North-West province of South Africa. To this end, six speakers (aged 35-60) read 4 instantiations of the three contexts in (2) with three repetitions each, resulting in 72 tokens for each context. The mean fundamental frequency (F0) of the final vowel of the noun (H1) was compared to the mean F0 of the initial vowel of the following word (H2). The results show that the mean difference in F0 between H1 and H2 across all speakers is significantly different from each other across all three contexts. Interestingly, it is only the steepness of the slope that differs significantly between (2a) and (2b) (mean $\Delta_{H1\text{-}H2}$ = 10.7 Hz and 18.2 Hz respectively, t= 3.539). However, it is the direction of the F0 change that is significantly different between (2a) and (2c) (mean $\Delta_{H1\text{-}H2}$ = 10.7 Hz and -3.4 Hz, t= -6.612). In other words, F0 decreases from H1 to H2 in (2a) and (2b), whereas F0 increases slightly in (2c). The latter is expected for the realisation of two adjacent high tones (cf. Zerbian & Barnard 2010), the former is expected for downstep.

The results suggest adopting Khoali's phrasal analysis of downstep in Southern Sotho also for the variety of Tswana under investigation. The talk will present the study and data analysis in detail and will discuss the findings with respect to structural conditions for downstep in Tswana. The implication of this result is that (a) downstep is also expected to occur between verb and object because they are commonly assumed to be in the same phonological phrase, and (b) downstep is not expected to occur in nominal modifications, such as enumerative, adjective, associate, and relative because of a phrase break similar to (2c).

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Templates as affixation of segment-sized units: the case of Southern Sierra Miwok

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Main Claim: I argue that certain templatic effects in Southern Sierra Miwok (SSM) follow from affixation of moras and underspecified segmental root nodes. The analysis avoids the assumption of CV skeletal positions or X-Slots, alternative analyses of SSM argue for (Sloan, 1991) and predicts the apparently templatic restrictions over whole strings of segments through the affixation of segment-sized phonological elements.

Background: In SSM (Broadbent, 1964; Sloan, 1991), suffixes can require the preceding stem to conform to a certain shape (=template-requiring affixes), a phenomenon that can be found in e.g. Yawelmani as well (Archangeli, 1984, 1991). I focus on three particularly interesting classes of affixes discussed in Sloan (1991) that all require a preceding bisyllabic LH stem but vary in the shape of the final syllable. Whereas affixes of class I require a closed final syllable (e.g. *−kuH* 'evidential passive predicative' (1)-a+b), affixes of class II require a long final vowel CVː (e.g. *−t* 'to do what is characteristic of' (1)-c+d). Stems preceding affixes of class III are either CVC or CVː-final. The choice for one or the other syllable shape depends on the number of stem consonants: biconsonantal stems surface as CV.CVː (1)-e and three-consonantal stems as CV.CVC (1)-f. The phonological strategies that may apply to ensure that the stem conforms to these form requirements are *i.* CV-metathesis (as in a.), *ii.* /y/- and /ʔ/-epenthesis, *iii.* vowel shortening (all in b.), *iv.* consonant deletion, *v.* vowel lengthening (all in c.) and *vi.* degemination (as in d.). The three classes of affixes then result in the surface sequences CV.CVC and CV.CVː, distributed differently for bi- and three-consonantal stems, cf. (2).

(1) *Template-requiring affixes*

	stem		(+other suffix)	+template-requiring suffix	
a.	ʔamla	'to wound fatally'	ʔamla-NHe	**ʔamal-kuH**	'crippled'
b.	wyːn	'to walk'	wyn-si	**wynyʔ-kuH**	'someone is evidently going . . . '
c.	paTyH	'to carry in one's arms'	paTy-ksY	**paTyː-t**	'to take, carry'
d.	molːi	'shade'	moli-mh	**moliː-t**	'to get dusk'
e.	hoːja	'to go first'	hojaʔ-peH	**hojaː-na**	'to start for'
f.	ʔenh	'to make'	ʔenhy-paH	**ʔenyh-na**	'to make for'

(2) *LH-requiring suffixes*

	biconsonantal stem	three-consonantal stem
class I requires	CV.CVC	CV.CVC
class II requires	CV.CVː	CV.CVː
class III requires	CV.CVː	CV.CVC

Sloan (1991) argues that the need to distinguish final CVC and CVː-syllables shows that assuming CV skeletal positions (McCarthy, 1979; Marantz, 1982) or X-Slots (Levin, 1985) alone is insufficient as representation for the templates in SSM. She proposes an analysis where the three templates in (2) are represented as (partially) syllabified X-slots with either branching or non-branching final nuclei and floating or non-floating X-slots.

Analysis: In contrast, I argue that the three LH templates in SSM are the simple result of affixing segment-sized defective phonological structure (μ and underspecified segmental nodes) that is independently argued for in numerous analyses for non-conconcatenative morphology (for an overview cf. Bermúdez-Otero (2011)). Crucial for the analysis of the three LH templates is the stress system of the language. SSM distinguishes light and heavy (CVC, CVː) syllables and only the latter can be stressed. Main stress is always on the first heavy syllable but must be on the first or second syllable. Callaghan (1987) states an explicit rule of iambic lengthening to achieve a good initial LH iambic foot (Hayes, 1995). Given this, I argue that all three LH templates follow from the demand that the first syllable is light, a requirement that is predicted from mora affixation and moraic overwriting. A moraic prefix must be integrated into the structure, i.e. must dominate the first vowel of the stem (Max-μ_{AF}) and due to the demand that morpheme boundaries coincide with prosodic boundaries (=Tautomorphemicity, cf. Crowhurst (1994); Bickel (1998)), a morpheme boundary on the moraic tier is dispreferred inside a syllable of the main foot. The prefixed mora is therefore the only possible mora inside the first syllable: it is light. From high-ranked Stress-to-Weight (Prince, 1990), AllFtL and RhT:I (Kager, 1999), the SSM effect of iambic lengthening is now predicted: if the first syllable is light, stress must be on a heavy second syllable. In (3), it can be seen how this simple μ-affixation predicts the affix template III. Metathesis is the optimal strategy to form a LH sequence for a stem *halki*.

(3) *Class III affixes*

(μ) μ μ μ h a l k i	Max-μ AF	Taut	SWP	Dep-S	Lin	Max-C
a. μ μ μ h a l k i	*!					
b. (μ)μ μ μ h a l k i		*!				
c. (μ) μ h a l i			*!			*
d. (μ) μ μ h a l i ʔ				*!		
☞ f. (μ) μ μ h a l i k					*	

The specifications of affix classes I and II that the stem must end in a closed syllable or a long vowel is predicted from affixing a defective segmental root node (Bermúdez-Otero, 2011; Bye and Svenonius, to appear) that is specified as vowel or consonant. If [+son,−cons] dominate a V-pl node (Schein and Steriade, 1986; McCarthy, 1988; Clements and Hume, 1995), a radically underspecified vowel results whereas [+cons] minimally specifies a consonant. These defective segments cannot be interpreted on their own but must be provided with minimally a place feature due to HavePlace (Ito and Mester, 1993; Padgett, 1994). Epenthesis ((1)-b.) or fusion with an underlying segment ((1)-d.) applies to ensure this. Whereas SSM prefers to fill the defective segment with underlying material even if this implies that the segment that undergoes fusion metathesizes as well ((1)-a.). The ranking of standard correspondence-theoretic faithfulness constraint −Dep, Integrity, Linearity (McCarthy and Prince, 1995) − predicts this preference. The underspecified segments are assumed to be part of the specification of a template-requiring affix (e.g. $-\bullet^{C}$*kuH*). O-Contig (Landman, 2002) then ensures that this segmental root node is realized in a position directly preceding the suffix.

Discussion: I argue that some defective phonological elements (μ, root nodes) predicting template-effects are morphemes on their own whereas others are part of the representation of segmental affixes (cf. the μ-prefix as morpheme on its own vs. the underspecified segmental root node as part of the representation of certain suffixes). Such an account unifies the 'templates' in SSM with other length-manipulating phenomena as e.g. pre-lengthening suffixes triggering gemination or vowel-lengthening (Brown, 2003).

Why do glottal stops and low vowels like each other?

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An investigation of phonological phenomena involving glottal stops and vowels shows that the presence of glottal stops influences the quality of the surrounding vowels: the vowels are lowered. For example, in Klallam, non-low vowels /i u ə/ are lowered to [ɛ o a], respectively, when followed by [ʔ]: /p‘íxʷŋ/ is pronounced as [p‘ɛʔxʷŋ] ‘overflow’/‘overflowing’ and /šúpt/ as [šóʔpt] ‘whistle’/‘whistling’ (Thompson et al. 1974).

Furthermore, it appears that glottal stops and low vowels are likely to co-occur from a typological point of view. Supportive evidence comes from various types of phonological processes. For example, in Besleney (an East Circassian language) the epenthetic vowel [ə] is realized as [i] in the context of palatalized consonants, as [u] in the environment of labialized consonants and as [a] adjacent to gutturals including laryngeals (Paris 1974; Rose 1996).

Lillooet (a Salish language) shows a clear coarticulation-induced variation in schwa-epenthesis: /ə/ changes to [ʊ] between labialized non-uvular/non-pharyngeal consonants ($C^w\_C^w$), to [ɔ] before labialised uvular/pharyngeal sounds, and to [ɪ] between coronal sounds. However, if a glottal stop follows the schwa, then the schwa changes to [a] (Show 1994).

In Karanga and Zezuru (dialects of Shona, a Bantu language) the hiatus is resolved in the following way: if the second vowel is /i/ or /e/, a glide [j] is inserted between the vowels. Where the second vowel is /u/ or /o/ a glide [w] is epenthesized. However, if the second vowel is /a/, then the glottal stop appears (Mudzingwa 2010).

In Tigrinya (an Ethio-Semitic language), the mid central vowel /ə/ is lowered to [a] following pharyngeals and laryngeals in the regular conjunction pattern. For example, /səbərə/ is pronounced as [ʔabərə] ‘he broke/he arrested’ (Berhane 1991).

Another piece of evidence comes from an investigation of German and Polish spontaneous speech (Zygis & Pompino-Marschall (to appear)). It has been shown that in both languages the word-initial low vowel /a/ is significantly more often glottalized or preceded by a glottal stop than a word-initial mid or high vowel.

The consistency with which this co-occurrence can be found in the most diverse languages leads to the assumption that it might be the result of a very general property of human articulatory and/or perceptual capacities. In fact, we will hypothesize that (i) low vowels and glottal stops share laryngeal settings, i.e. especially a retracted tongue root and a raised larynx (often due to the sphincter mechanism) and that (ii) glottalized vowels are perceived lower in their height.

Regarding (i) we will briefly compare and discuss the laryngoscopic data of glottal stops and low vowels from different languages. We will focus, however, on (ii) by presenting the results of a perceptual experiment on glottalized and non-glottalized vowels.

In this experiment we hypothesized that vowels are perceived lower in their height if they are glottalized. In order to test our hypothesis we conducted a perceptual experiment with a non-glottalized and glottalized German continuum *b[i]ten-b[e]ten* (‘to offer’- ‘to pray’). 23 German subjects took part in an identification test in which they were asked to indicate whether they perceived words from these continua as *b[i]ten* or *b[e]ten*. The data show very clearly that subjects perceive *b[e]ten* more often, i.e. earlier in the continuum, than *b[i]ten* if the vowel is glottalized (LMM, $p<.001$).

The results indicate that the co-occurrence of glottal sounds and low vowels in the different world languages could potentially originate in a reinterpretation of glottalized higher vowels as lower ones.

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