The Twenty-First Manchester Phonology Meeting

21

fəˈnɒlədʒi

ABSTRACTS BOOKLET

Thursday 23rd - Saturday 25th May 2013

Held at
Hulme Hall, Manchester

Organised by a collaboration of phonologists at the
University of Edinburgh, the **University of Manchester**, and
elsewhere.

This booklet contains the abstracts for all the papers presented at the **twenty-first Manchester Phonology Meeting**, held at Hulme Hall, Manchester, in May 2013.

The abstracts are arranged in alphabetical order by the surname of the (first named) presenter. If any abstracts are missing from this booklet, it is most likely because the authors did not submit a non-anonymous version of their abstract.

The abstracts for the **oral paper sessions** are presented first, followed by the abstracts for the **poster paper sessions**, and the booklet concludes with abstracts for the **special session**.

The **final programme**, included in your registration pack and available on the conference website, gives the details of which papers are in which room, and at which times.

Oral papers

Biased learning of phonological alternations

Adam Albright and Young Ah Do (MIT)
albright@mit.edu, youngah@mit.edu

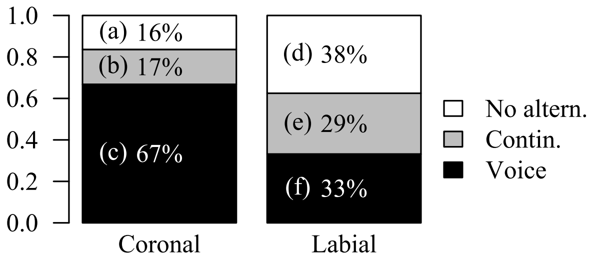
What expectations do learners bring to the task of acquiring alternations? We provide evidence for three biases: (1) a bias against alternations, favoring uniform paradigms (McCarthy 1998); (2) a bias in favor of alternations that target broader classes of segments (Peperkamp et al. 2006); (3) a substantive bias against perceptually salient alternations (Steriade 2001).

To test learners' biases, we ran two Artificial Grammar experiments. Adult English speakers were taught nonce sg~pl pairs: *plɔɹ~plɔɹi*. Obstruent-final stems had either voicing or continuancy alternations. Coronals alternated more often in voicing in exp. 1 and in continuancy in exp. 2, while labials showed the opposite trend. In both experiments, coronal-final stems outnumbered labials, so provided most evidence about alternations. Participants then chose plural forms for untrained items; the options included non-alternation, voiced stops, or continuants.

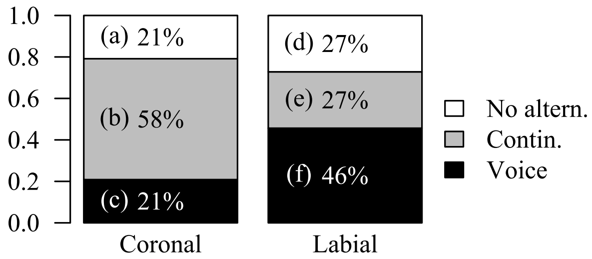
Exp 1: Voi	Coronal	Labial	Total
Continuancy	t~s 3	p~f **6**	9
Voicing	t~d **13**	p~b 3	**16**

Exp 2: Contin	Coronal	Labial	Total
Continuancy	t~s **13**	p~f 3	**16**
Voicing	t~d 3	p~b **6**	9

(1) Exp 1 (voicing dominant) results



(2) Exp 2 (continuancy dominant) results



Participants generally preferred the most frequently trained segmental alternations: (1c), (1e); (2b), (2f). However, their responses diverged from the trained frequencies in several ways. First, they often selected non-alternating plurals, especially for the less frequent labials ((1d), (2d)), even though *all* obstruent-final stems alternated in training. We attribute this to a prior bias against alternations (output-output faithfulness). Second, the preference for frequent alternations was weaker among labials ((1e), (2f)) than coronals ((1c), (2b)). We attribute this to a bias for simpler or more general patterns: learners assume that labials and coronals pattern alike, and choose an output for the rarer labials based (partly) on what is most frequent among coronals. Finally, the degree of this influence differs across the experiments: participants extended voicing from coronals to labials ((1f)) more than continuancy ((2e)). We interpret this as a substantive bias: learners demote OO-Ident(±voi) more readily than OO-Ident(±cont).

We model these results with a maximum entropy grammar that includes paradigm uniformity constraints (OO-Ident for voicing, continuancy), along with markedness constraints that can motivate or inhibit alternations, both specific (*VpV, *VtV, *VbV, *VdV) and general (*V[vcd stop]V, *V[vcls stop]V). The model is trained on the artificial languages, and finds constraint weights using Stochastic Gradient Ascent (Jäger 2007). We model the bias for non-alternation by assigning OO-Ident constraints high target weights, so they are initially obeyed. We model the bias for simplicity by letting the model adjust general constraints more readily than specific ones; thus, *V[vcls stop]V is favored over *VtV as an explanation for coronal alternations. We model the bias for voicing by letting the model adjust OO-Ident(voi) more readily than OO-Ident(cont). With these three biases, the model achieves a very close match to the participants' distribution of non-alternation, continuancy, and voicing responses: Exp 1 coronals 19%, 11%, 69%, labials 35%, 30%, 35%; Exp 2 coronals 17%, 67%, 17%, labials 31%, 30%, 40%. We show that the model matches human preferences significantly better than models lacking these biases, and discuss implications for models of phonological acquisition.

Grammar inference expresses source-oriented generalizations in Russian yer deletion

Michael Becker (Indiana University, michael.becker@phonologist.org)
Maria Gouskova (New York University, maria.gouskova@nyu.edu)

In constraint-based and schema-based theories, markedness constraints and schemas express *product-oriented* generalizations: a process applies if the output satisfies certain requirements (Bybee & Slobin 1982, Bybee & Moder, 1983, Bybee 2001). In rule-based grammars, generalizations are *source-oriented:* a rule applies if inputs look a certain way (Albright & Hayes 2003). We show that mid vowel deletion (*yer* deletion) in Russian follows both source-oriented and product-oriented generalizations, which we model using multiple constraint-based phonotactic grammars learned over subsets of the lexicon.

Russian lexicon. Deletion can create CCC clusters with a medial obstruent ([kastʲor ~ ka<u>str</u>a] 'fire NOM/GEN'), but not a medial sonorant ([mudreʦ ~ mudreʦa] 'wise NOM/GEN', *[mu<u>drʦ</u>a]). This is a *product-oriented* generalization (Yearley 1995). Deletion can create CCC clusters, e.g. [kastʲor ~ ka<u>str</u>a], but not if the base ends in a complex coda, *[kaso<u>tr</u> ~ ka<u>str</u>a]. The product clusters are identical, so the generalization is *source-oriented*.

Experiment. We tested these generalizations in a nonce word task ("wug test", Berko 1958): 115 Russian speakers each rated 48 nonce words created from a pool of 403 consonant combinations (~14 responses per consonant combination). People rated the nominative base form such as [s̯om] on a scale of 1–5. Then two genitives appeared in random order, the faithful [s̯oma] and the yerless [s̯ma], which people rated as acceptable or unacceptable (yes/no).

The product-oriented sonority generalization is productive: people liked deletion best when it created TR, RTR & TTR clusters (T=obstruent, R=sonorant). The source-oriented coda cluster generalization is also productive: people disliked deletion that created CCC clusters from CC# bases (ps̯om ~ ps̯ma > pos̯m ~ ps̯ma). Both effects were highly significant ($p<.0001$) in the statistical analysis (mixed-effects logistic regression model with maximal random slopes).

Analysis. Speakers judge deletion based on the wellformedness of the product and on whether the source is a plausible yer word. Once speakers identify words that undergo a process, such as vowel deletion, these words are separated from the general lexicon (cf. Ito & Mester 1995; Pater 2006). Phonotactic generalizations are then learned on each sublexicon separately. In Russian, nominative masculine yer words never end in CC#, so a *CC# constraint is weighted higher for this sublexicon than for the non-yer sublexicon, where coda clusters are common. People use the nominative yer phonotactic grammar *to infer whether the yer grammar can apply* – it acts as a gatekeeper when judging nonce paradigms. The product-oriented sonority generalization is learned from the yer genitives, which have restricted sonority profiles compared to non-yer genitives. The probability of a yer paradigm is computed from its status in both subgrammars.

Simulation. We trained the UCLA Phonotactic Learner (Hayes & Wilson 2008) on 1,902 real yer words (from Zaliznjak 1977) in the nominative and genitive, and tested the resulting grammars on our wugs. The grammar trained on the nominative yer sources correctly learned the source-oriented *CC# constraint, but it failed to prefer (C)TR clusters. The grammar trained on yerless genitives missed the source-oriented *CC# generalization, but it correctly found the product-oriented sonority generalization. For our full implementation of the grammatical mechanism, we combined the two grammars, such that we were able to correctly capture both kinds of generalizations and closely match the participants' treatment of the nonce words.

Voicing as suppression to sonorancy: the case of voiced fricatives

Bert Botma & Marijn van 't Veer (Leiden University Centre for Linguistics)

Background. In phonology, an oft-cited diagnostic for markedness is implication: a segment X is more marked than a segment Y if the presence of X implies the presence of Y. For example, the presence of voiced plosives in a language implies that of voiceless ones, but not vice versa. Such implicational relationships have been used as a diagnostic for the relative structural complexity of segments, in particular in single-valued approaches.

Problem. Surprisingly, typological work on fricatives has shown that "bilabial, dental and palatal non-sibilant fricatives are found to occur without a voiceless counterpart more often than with one" (Maddieson 1984:48, UPSID) (and about 1/3 of the languages in UPSID with /ɣ/ lack /x/). The same picture emerges from more recent typological work (Mielke 2008, P-Base). This is contrary to what would be expected on the basis of markedness relations.

Interpretation. This problem is only apparent. Inspection of the typological data suggests that the majority of the offending fricatives display one of the following two properties:

(i) They display oral–nasal alternations

An example is found in Kpelle (Mande; Welmers 1962), where /ɣ/ alternates with /ŋ/ under nasal harmony. Following among others Rice (1993), we argue that such fricatives function as sonorants, whose unmarked status is to be voiced.

(ii) They are the diachronic result of intervocalic voicing

An example is found in Uradhi (Northern Paman; Crowley 1983), where Proto-Paman **p* **t* **k* have the reflexes /β ð ɣ/. There are good grounds to analyze these sounds as sonorants also. Fricatives are in general extremely marginal in Paman. Analyzing /β ð ɣ/ as fricatives would imply that Uradhi violates the markedness relation between voiceless and voiced fricatives, and also the universal implication that if a language has a fricative, it is a sibilant (Maddieson 1984), given that Uradhi lacks /s/. In addition, Crowley's informal description of these sounds suggests that their realization is approximant-like.

Implication. Our analysis has an important consequence for the interpretation of intervocalic voicing. An account of this process in terms of the addition of [voice] is not compatible with the observation that voicing in obstruents is marked, nor with the idea that lenition involves the loss of complexity.

Proposal. Instead, we maintain that intervocalic voicing receives a natural account in the Modulation Theory of Speech (Traunmüller 2003; see also Harris 2006). According to this theory, speech involves linguistically informative modulations of a carrier signal – the periodic sound produced by a neutrally open vocal tract. We propose that the carrier signal is manifested phonetically in sonorants, but is masked in obstruents on account of their greater articulatory constriction. Intervocalic voicing can then be analyzed as reduction to sonorancy, formalized in terms of the suppression of (single-valued) melodic material.

Two arguments for vowel harmony by trigger competition

Samuel R. Bowman, Stanford University – sbowman@stanford.edu

I present two case studies as evidence for the new Trigger Competition framework for vowel harmony: Hungarian vacillation and Seto neutral (non-harmonizing) vowels are difficult to explain in standard theories of harmony, but emerge straightforwardly in the new system.

Trigger Competition (Kimper, 2011) is based on a positive harmony constraint (or imperative) set in Serial Harmonic Grammar (SHG, Pater et al., 2008), and uses an autosegmental representation with crossing lines to represent harmony in a way that directly permits nonlocality and transparent vowels. The framework takes advantage of SHG's weighted constraints to incorporate two properties of harmony as factors influencing reward assigned to each instance of harmonic spreading: A distance multiplier expresses a preference for short-distance over long-distance spreading and a set of multipliers for trigger strength expresses a preference for perceptually impoverished (confusable) vowel types over others as triggers.

Hungarian vowel harmony shows a pattern of optionality in its handling of neutral vowels in suffixes (Benus et al., 2003) that can be difficult to account for in constraint-based grammar.

(1) *a. papír-ban* *b. ágnes-ban/ben* *c. oxigén-ban/ben* *d. kabinet-ben*

After a back vowel, single transparent vowels select for back vowel suffixes (1a). [e] or pairs of transparent vowels allow for free choice between front or back vowel suffixes (1b,c). Transparent vowels followed by [e] require front vowel suffixes (1d). These phenomena are quite difficult to account for without a notion of trigger strength, but they emerge naturally in Trigger Competition: A reasonable attempt to capture the rest of Hungarian yields a grammar in which the back vowels are strong triggers, /e/ is a less strong trigger, and the three transparent vowels are weaker still. If the distance multiplier is set within a certain range, the interaction between the distance and trigger strength preferences yields just what we observe: In cases like (1a) back triggers win out over weak transparent vowels, in cases like (1b,c) front and back triggers tie, and in cases like (1d) /e/ wins out over the distant back vowel and triggers front harmony.

Seto (Finno-Ugric, Estonia; Kiparsky and Pajusalu, 2001) shows progressive backness harmony with both common types of neutral vowel: [i] and [e] are transparent ([e] only word-initially), and [o] is opaque. Each neutral vowel has a counterpart of the opposite backness value ([ɨ], [ɤ], and [ø]) which can appear in many of the same harmonic environments, shown below with both back [ɨ] and transparent [i] apparing before [a]:

(2) *a. sɨna* 'you' *b. tsiga* 'pig' *c. imä* 'mother'

These paired transparent vowels in particular defy analysis under the two standard approaches to transparency in local vowel harmony: Neutralization accounts (Bach, 1968, Baković and Wilson, 2000, ...) propose that transparent vowels harmonize, but are neutralized back to a default value at some point late in the grammar. These would be unable to generate, for example, Seto's non-neutralized back [ɨ]. Similarly, underspecification accounts (Clements, 1976, Ringen and Vago, 1998, ...) suppose that transparent vowels do not contrast for the harmonic feature and are thereby immune to harmony. These would have trouble generating the observed contrast between front [i] and back [ɨ] in Seto.

Trigger Competition makes no stipulations about the counterparts of neutral vowels: If any faithfulness or markedness constraint prevents a vowel type from alternating, it will be neutral, and if it is a weak trigger, it will be transparent. These facts make it possible to account for Seto without stipulating anything typologically unusual about the language.

Phonological variation and entailments in conditioned vowel shift:
A case study of English o-fronting

Hsin-Chang Chen
Stanford University, chenhc@stanford.edu

This paper provides a variationist Optimality-Theoretic account for the conditioned vowel shift of o-fronting, as that attested in English dialects, based on a spoken corpus of Californian English. I argue that harmonic alignment (Prince and Smolensky 1993/2004) and the universal implicational hierarchy of T-order (typological order) (Anttila and Andrus 2006) are at the heart of the phenomenon and can best account for the statistical entailment relationships of the differential o-fronting powers of conditioning consonants.

First, I establish that phonological grammar is at the root of the sound shift phenomenon, where coronal (T), dorsal (K), labial consonants (P), and the velarized lateral (L) have differential fronting powers, statistically supported by the corpus and corroborated by data from Altamura Italian (Calabrese 2000). I also show that a three-degree phonological o-fronting is most appropriate based on examination of the vowel space and statistical support -- the three versions of /o/ in terms of *front*ness are termed O3, O2, O1, representing [ɛ̞ʊ], [əʊ], [oʊ] respectively. From (a) the universal scales of o-frontness and (b) consonant fronting powers, harmonic alignments can be made, giving rise to harmony scales (c/d) from which universal constraint hierarchies (e-h) can be derived.

a. Frontness:	O3 > O2 > O1	
b. Fronting powers:	T > K > P > L	
c. H_{O3}:	O3/T > O3/K > O3/P > O3/L	
d. H_{O1}:	O1/L > O1/P > O1/K > O1/T	
e. C_{O3}:	*O3L >> *O3P >> *O3K >> *O3T	(for O3-consonant sequence)
f.	(*LO3) >> *PO3 >> *KO3 >> *TO3	(for consonant-O3 sequence)
g. C_{O1}:	*O1T >> *O1K >> *O1P >> *O1L	(for O1-consonant sequence)
h.	*TO1 >> *KO1 >> *PO1 >> (*LO1)	(for consonant-O1 sequence)

Typologically, the resulting four constraint hierarchies (e-h) plus the constraint *O2 produce the patterns of o-fronting attested in English dialects concerning the major consonant places and match the implicational relationships of consonant-conditioned variation fairly well (e.g. an instance of the sequence TO1 implies more instances of KO1, which in turn implies more instances of PO1) in the data (precision = 0.97). This set of constraint hierarchies has the prediction that for the entire life span of o-fronting, either mild, moderate, or strong, the relative fronting powers of the consonant categories stay constant, which does not run counter to any reported case. Finally, by comparing it with two potential alternative solutions in terms of predictive power and simplicity of constraints, I argue that this entailment approach based on harmonic alignment is typologically the most accurate.

In sum, this paper shows on empirical and theoretical grounds that the mirror universal constraint hierarchies derived from harmonic alignment explain the fine-grained variation of o-fronting in languages and capture the phenomenon fairly well in implicational terms. It is suggested that similar phenomena of conditioned vowel shift can be accounted for by harmonic alignment of similar scales yet to be discovered.

Polish voicing assimilations and Laryngeal Relativism

Eugeniusz Cyran
John Paul II Catholic University of Lublin, Poland
cyran@kul.pl

Analyses of systems containing a two-way voicing contrast typically aim to provide theoretical tools to answer the descriptive problems of: i) specification, ii) voice related phenomena such as Voice Assimilations (VA), Final Devoicing (FD), and possibly the role of sonorants as targets and triggers. In the existing analyses of Polish voicing (e.g., Bethin 1984, 1992; Gussmann 1992, 2007; Lombardi 1991; Mascaró 1987; Rubach 1996) Regressive VA (e.g. *ryba – ryb-ka* [rɨb̲a – rɨp̲ka] 'fish, nom.sg./dim.') and FD (e.g. *ryba – ryb* [rɨb̲a – rɨp̲] 'fish, nom.s.g/gen.pl.') seem to be unproblematic, regardless of whether the model uses binary or privative specification, especially if additionally armed with rule ordering, ordered defaults, suspension of universal conditions, and the like.

However, models stumble over two celebrated phenomena in Polish: the so called Cracow-Poznań (CP) sandhi voicing and Progressive Assimilation. The former, which takes place across word boundaries in one dialect group of Polish (south-western), involves sonorant triggers and is particularly problematic for privative models, especially those which do not allow for even late [+voice] filling on sonorants (e.g. *brat ojca* [brad̲ ɔjt͡sa] 'father's brother', *brat mamy* [brad̲ mamy] 'mother's brother', cf. [brat̲ ɔjt͡sa] in Warsaw Polish (WP)). Progressive VA is problematic for any theory because it involves a potential bleeding relation between the regressive (regular) and the progressive (restricted) assimilation (e.g. *marchewa* [marxɛv̲a] 'carrot, augm.' but *marchwi* [marxf̲ʲi] 'carrot, gen.' and not *[marɣ̲v̲ʲi]).

The proposal is a modification of a restrictive privative system called Laryngeal Realism (e.g. Honeybone 2002, 2005), which has been applied to Polish in Gussmann (2007). The main difference between Realism and Relativism is that the latter takes the established distinction between the so called 'voicing' and 'aspiration' languages to be correct phonetically, but certainly not phonologically. It is argued that Polish possesses two opposite laryngeal systems in CP and WP dialect groups. The former is an {H}-system, in which full voicing (long negative VOT) is a result of enhanced passive voicing of a laryngeally neutral segment (the voicing is systemic/interpretational, not phonological), while the latter is an {L}-system, in which full voicing directly corresponds to the element {L}. This requires a different perspective on phonetic interpretation in Element Theory and the relation between phonology and phonetics: one which is based on arbitrary relations between phonological and phonetic categories. The phonetic interpretation conventions in the two dialects of Polish yield identical phonetic facts, that is, symmetrical voice assimilations and final obstruent devoicing when limited to the domain of word. However, the true linguistic nature of all these phonetic phenomena is different. As a consequence, not every final devoicing or assimilation of voice can be viewed as a proper phonological phenomenon. This, in turn, suggests that all the classic criteria for categoryhood in laryngeal phonology must be treated with reservation. The spectrograms are not telling us what type of system we are dealing with. They only provide the information on the phonetic side of the equation.

CP sandhi voicing is now limited to one phonological operation (word-final delaryngealization), which exists in both dialects, except that a different category is deleted (H, not L), and the resultant neutral obstruent has a different interpretational status in the two systems. In CP it is passively voiced in a (phonetically) voiced environment – an exact copy of the word-internal situation – and no [+voice] on sonorants is needed. The analysis of Progressive Assimilation can also be radically simplified, avoiding rule ordering, sonorant specification, obstruentization rules and progressive delinking. Crucially, the analysis will also cover two typically omitted facts: i) the absence of Progressive or Regressive assimilation in some varieties of Polish (e.g. [marx̲v̲i]) and that, normally, speakers who have progressive assimilation across [r] in *krwi* [krf̲ʲi] 'blood, gen.' do not show it across [l], as in *plwociny* [plv̲ɔt͡ɕinɨ] 'spit', contrary to what previous formal approaches would generate.

A constructive solution to the ranking problem in Partial Order Optimality Theory

Alex Djalali & Arto Anttila   Stanford University   {djalali, anttila}@stanford.edu

PARTIAL ORDER OPTIMALITY THEORY (PoOT) (Anttila & Cho 1998) is a conservative generalization of CLASSICAL OPTIMALITY THEORY (COT) (Prince & Smolensky 1993) that makes possible the modeling of free variation and quantitative regularities without any numerical parameters. Solving the RANKING PROBLEM for PoOT has so far remained an outstanding problem: allowing for free variation, given a finite set of input/output pairs, i.e., a dataset, Δ that a speaker $\mathscr{S}$ knows to be part of some language $\mathfrak{L}$, how can $\mathscr{S}$ learn the set of all grammars $\mathscr{G}$ under some constraint set $\mathscr{C}$ compatible with Δ?

In the context of COT, Brasoveanu & Prince (2011) define an algorithm, i.e., the FUSIONAL REDUCTION ALGORITHM, that, for an arbitrary Δ, determines the maximally informative necessary and sufficient conditions on a $\mathscr{G}$, all and only of whose members are compatible with Δ. More precisely, they determine the maximally informative necessary and sufficient conditions on all the possible STRICT TOTAL ORDERS of $\mathscr{C}$ that are compatible with Δ. In this paper, we go a step further: allowing for free variation, given the set of all PoOT grammars $\mathscr{G}_{PoOT}$ over a constraint set $\mathscr{C}$, for an arbitrary Δ, we provide set-theoretic means for constructing the actual set $\mathscr{G}$ compatible with Δ, not just the necessary and sufficient conditions on Δ. Specifically, we determine the set of all STRICT ORDERS of $\mathscr{C}$ that are compatible with Δ. As every strict total order is a strict order, our solution is applicable in both PoOT and COT, showing that the ranking problem in COT is a special instance of a more general one in PoOT.

The benefits of our construction are threefold. From a grammatical perspective, a solution to the ranking problem allows PoOT to be resituated next to other theories of variation like STOCHASTIC OPTIMALITY THEORY that already has a solution to the ranking problem in the GRADUAL LEARNING ALGORITHM (GLA) (Boersma 1997). From a mathematical perspective, the work here is a novel result and situates the ranking problem in the familiar set-theoretic universe, thus allowing the relationships between constraint sets, datasets, and PoOT grammars to be studied precisely. For example, in this setting, questions like 'Which PoOT grammars G compatible with a dataset Δ best fit that set?'; or 'Which PoOT grammars G compatible with a dataset Δ make the most robust empirical predications?' can be articulated and answered precisely. From an algorithmic perspective, the computational implementation of the work here provides the PoOT-theorist means to determine, with only a constraint set in hand, in one fell swoop, and with absolute confidence, the set of all PoOT grammars compatible with a dataset.

We illustrate our solution by applying it to Vowel Coalescence (VC) in Colloquial Helsinki Finnish nouns (Paunonen 1995; Anttila 2009). VC applies variably across morpheme boundaries (*ove-a* $\rightarrow$ *ovee* 'door-PAR') , but is blocked within roots (*idea* $\not\rightarrow$ **idee* 'idea') and applies more frequently to mid-low sequences (e.g., /ea/ $\rightarrow$ *ee*) than to high-low sequences (e.g., /ia/ $\rightarrow$ *ii*). Within the space defined by the four constraints FAITH-ROOT, FAITH, *MID-LOW-HIATUS, *HIATUS, our algorithm discovered 11 partially ordered grammars compatible with the data. These grammars define a tightly limited space of variation that allows for certain kinds of quantitative variation across speakers and lexical items while preserving the key grammatical generalizations intact.

MULTIPLE REPAIRS FOR VOICED VBSTRUENT CODAS IN BERBICE DUTCH CREOLE

Michael Dow (mcdow@indiana.edu), Indiana University

Lombardi (2001) claims that devoicing is the only possible repair for a ban on voiced obstruent codas (hereafter voiced codas); this has become widely accepted in the literature, explicitly supported by Steriade (2001/2008) and Kawahara and Garvey (2010). However, José and Auger (2004) document a case of nasalization repairing voiced codas in Vimeu Picard. In this paper, I present a case of deletion and epenthesis as repairs of voiced codas in Berbice Dutch Creole (Kouwenberg 1994). Together with Picard, the newly expanded typology requires a rejection of Lombardi's analysis, which relies on the exclusion of *VOICEDCODA and ID(voice) from CON. I analyze the observed typology using these exact two constraints.

Berbice (a Dutch-Ijo creole spoken in Guyana from the 17th century till its death in 2005) frequently exhibits deletion of unstressed vowels (1a), but deletion is blocked only where a voiced stop would result in coda position (1c).

		Root form(s)	*UR*	*Example*	
(1)	a.	[...TV#], [...T#]	/...TV#/	[deki, dek]	'take'
	b.	[...T#]	/...T#/	[tap]	'dip'
	c.	[...DV#]	/...DV#/	[saba], *[sab]	'cross'
	d.	[...DV#]	/...D#/	[fligi], *[flig]	'fly'

I analyze this blocking pattern with a ranking of *VOICEDCODA >> *UNSTRESSEDVOWEL >> MAXV. Lombardi's analysis cannot extend to this case because it has no constraint that prefers the output [saba] over the ungrammatical *[sab]. Though abstract, this grammar also allows for epenthesis in /flig/ → [fligi] (1d), in keeping with Richness of the Base.

The data in (2) show evidence for deletion and epenthesis as a repair for voiced codas. The optionality in (2a) must be due to epenthesis after /maŋg/, since the hypothetical underlying /maŋgi/ would block deletion as in (1c) and (2b). The stable final nasal in (2c) rules out /maŋ/, and the stable voiceless stop in (2d) rules out /maŋk/.

(2)	a.	[...NDV#], [...N#]	/...ND#/	[maŋgi, maŋ], *[maŋg]	'run'
	b.	[...NDV#]	/...NDV#/	[lombo], *[lom], *[lomb]	'do bad'
	c.	[...N#]	/...N#/	[swem], *[swembu]	'swim'
	d.	[...NTV#], [...NT#]	/...NTV#/	[kantɛ, kant]	'cannot'

I analyze /maŋg/ → [maŋgi] using *VOICEDCODA >> MAXC >> DEP >> *UNSTRESSEDVOWEL, and the deletion scenario in /maŋg/ → [maŋ] differs only in the ranking of DEP >> MAXC. Since voicing alternations are never observed in the language, something enforcing faithfulness to [voice] is required. However, as Lombardi's MAX(voice) is violated by /maŋg/ → [maŋ], this constraint would have to be ranked below *VOICEDCODA, thus unable to block /maŋg/ → *[maŋk]. Hence, ID(voice) has to be allowed in CON, *contra* Lombardi. My approach is compatible with either a binary view of [voice] (e.g. Wetzels & Mascaró 2001) or a privative view (e.g. Kaye, Lowenstamm & Vergnaud 1985, Zonneveld 2007).

Steriade's (2001/2008) P-Map approach relies on fixed universal rankings to limit the typology. Since voiced codas can be repaired in at least four different ways (most frequently devoicing, but also nasalization, epenthesis, and deletion), the relevant faithfulness constraints cannot be in a fixed ranking. However, if we indeed ascribe to the claims that devoicing is perceptually the least costly repair (Kawahara & Garvey 2010), then the ranking of faithfulness must reflect a mere bias rather than a fixed fact.

*NT Revisited Again

Laura J. Downing (Göteborgs universitet) & Silke Hamann (Universiteit van Amsterdam)
laura.downing@sprak.gu.se & silke.hamann@uva.nl

Background: While it is uncontroversial that it is less marked for obstruent stops to be voiced, rather than voiceless, following a homorganic nasal consonant, Pater's (1999) formulation of the OT constraint to account for this generalization – here called *NT – has been criticized almost from the beginning. As Pater himself acknowledges, a constraint simply banning nasal/voiceless obstruent sequences makes the implausible prediction that voiceless obstruents are optimally voiced following voiceless nasals. Work since Hyman (2001; see, too, Coetzee & Pretorius 2010; Gouskova et al. 2011; Solé et al. 2010; Solé 2012) has shown that *NT also incorrectly predicts that no language should devoice obstruents following a nasal, yet that is what we find in at least some dialects of Setswana.

Neglected *NT patterns: In this talk we take up another problem with the original *NT constraint, namely, that it has nothing to say about the common pattern (Kadima 1969, Kerremans 1980, Huffman & Hinnebusch 1998) in which postnasal voiceless stops are aspirated, so that the contrast between voiced and voiceless stops is enhanced, rather than neutralized, in postnasal position: NT → NT^h. It also has nothing to say about languages which not only contrast aspiration in stops but also have contrastive voicing (T, T^h, D). In several of these languages, the postnasal pattern one finds is that a voicing contrast is maintained, while the aspiration contrast neutralizes: e.g., in Cinsenga, Chichewa (Miti 2001) and Tumbuka (Vail 1972), {NT, NT^h} → NT^h ; ND → ND.

These problems are shared by Halpert's (2010, 2012) analyses of NT alternations, which are formalized in terms of gestural (mis-)alignment within a homorganic NC sequence. As she notes, homorganic sequences are shorter than non-homorganic, and she proposes that this motivates realignment of the gestures associated with the consonants in the sequence. Postnasal aspiration of a voiceless consonant follows, in her account, from misaligning the open glottis gesture of the plain voiceless consonant and the release of the stop, as a result of shortening the stop closure. However, as Huffman & Hinnebusch (1998) argue, aspiration involves a greater glottal opening than plain voiceless stops, and simple gestural shift would not result in aspiration.

Our proposal: What we propose is that the range of laryngeal alternations in the NT context is better accounted for if *NT is recast in perceptual, rather than purely articulatory, terms. As work like Ohala & Ohala (1993) and Solé (2012) observes, a phonetically voiceless obstruent stop is easily perceived as voiced in postnasal position, as it has a weak release burst (and is short in duration). That is, postnasal voiceless stops minimally violate the following cue constraint: (1) *[weak burst]/T/ (Don't map a weak burst in the auditory representation onto a voiceless plosive in the phonological representation, and vice versa).

It is unsurprising that one common phonological response to the cue constraint is for the voiceless stop to undergo voicing assimilation: reduced stops that occur between sonorants commonly undergo this kind of lenition. (See e.g. papers in Brandão de Carvalho et al. 2008.) In a perceptual account, it is equally unsurprising for aspiration of the voiceless stop to be another common phonological response. Aspiration strengthens perceptibility of voicelessness, enhancing the contrast with a postnasal voiced stop and maintaining this laryngeal contrast in the phonological system. This approach also accounts for languages where {NT, NT^h} neutralize to NT^h, as this process satisfies the voicing cue constraint.

Formal account: The difference between postnasal voicing languages and postnasal aspiration languages, then, follows straightforwardly from the high-ranked postnasal voicing cue constraint in (1) and different rankings of distinct laryngeal FAITH constraints. Postnasal voicing is unfaithful to the stop's input representation, as it violates DEP [voice]. Postnasal aspiration, in contrast, is faithful for [voice], but it violates DEP [spread glottis].

Contrastive Vowel Features in West Germanic

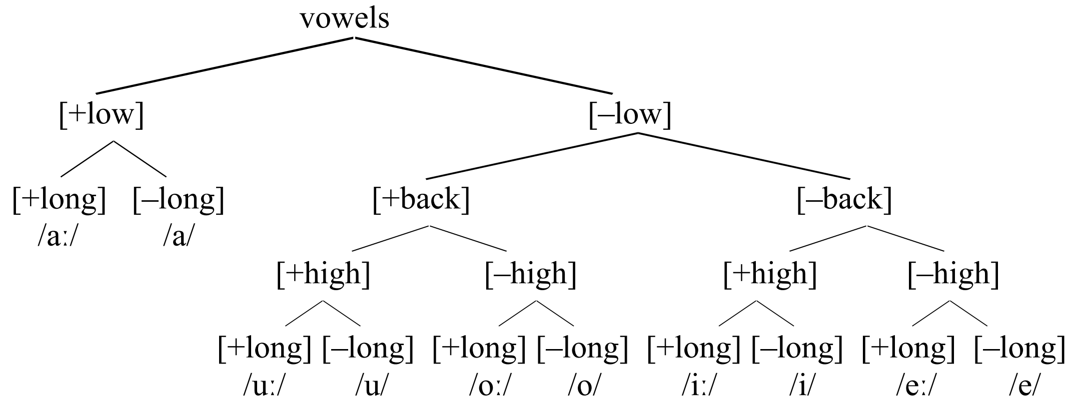
B. Elan Dresher, University of Toronto (dresher@chass.utoronto.ca)

The insight that phonological change may involve a reorganization of the contrasts of a language goes back to Jakobson (1931), who argued for a structuralist phonemic approach (see Salmons & Honeybone to appear). Hogg (1992) provides a number of interesting illustrations of instances where his Neogrammarian predecessors have been unable to give a satisfactory account of developments in early Old English because they lacked a phonemic perspective. I show that some of these insights are not expressible in a theory that requires full specification of underlying segments. These insights can be recaptured, however, if underlying forms are specified only for contrastive features.

One example concerns the prehistory of early OE long *æ:*. Since the corresponding vowel in Proto-Germanic is assumed to have also been *æ:, Wright & Wright (1925) propose that *æ:* persisted into the Old English period. Against this view is historical and comparative evidence which appears to show that it was a back vowel, *a:, in West Germanic. Most other writers therefore posit that P-G *æ: retracted to WGmc *a:, then fronted again to OE *æ: when not before a nasal. Hogg (1992: 61–3) argues that the alleged shift of P-G *æ: to WGmc *a: and then back to *æ:* in Old English and Old Frisian emerges as an artefact of a non-phonemic theory, once we consider the contrasts in play at each stage. He proposes that, in the WGmc dialects from which Old English developed, '*/æ:/ is the only low long vowel and there is no front/back contrast in operation. From the structural point of view, therefore, the vowel as it develops in WGmc may be considered to be neutral in this last respect, that is, */a:/', whatever its precise phonetic character. This suggests that */a:/ (as well as short low */a/) should not be specified as being either [+back] or [–back]; thus, its pronunciation could have remained [æ:] all along, while its contrastive feature specifications changed.

We can translate Hogg's insight into an explicit theory if we posit that contrastive specifications are assigned by ordering features into a hierarchy (Dresher 2009; Purnell & Raimy to appear). On the assumption that active features are contrastive (the Contrastivist Hypothesis, Hall 2007), phonological activity can serve as a heuristic to ordering the features. One way of ordering the features so that the low vowels have no specification for [front/back] is shown in (1). This ordering, [low] > [back] > [high] > [long], also requires that [round] be absent from the system. Purnell & Raimy (to appear) observe that this is supported by Lass's (1994) observation that rounding is non-distinctive in West Germanic. It is interesting to note further that there *is* evidence for an active [round] feature in Old English, which had a different set of vowel contrasts; I will argue that the OE order is [back] > [round] > [high] > [low] > [long]. Like the dog that didn't bark, the absence of evidence for active WGmc [round] requires an explanation, which is provided by the analysis in (1). It is significant that the evidence bearing on the activity and inactivity of different WGmc vowels converges on the tree in (1).

(1) Contrastive hierarchy for West Germanic vowels



Perceptual Epenthesis is modulated by Allophonic Features

Karthik Durvasula (MSU) and Jimin Kahng (MSU)
Email: kahngji@msu.edu, durvasul@msu.edu;

Perceptual epenthesis of illusory vowels has been claimed to be sensitive only to phonologically contrastive features, and not to allophonic features (Kabak & Idsardi, 2007). In fact, we will show that it is also crucially modulated by the allophonic features of a language.

Native speakers perceive illusory vowels when presented with sound sequences that do not respect the phonotactic constraints of their language (Dehaene-Lambertz et al, 2000; Dupouxet al, 1999). Kabak & Idsardi (2007) argue that it is only constraints on the phonologically contrastive features that trigger the perceptual illusions. In Korean, voicing in stops is not contrastive, and is allophonically-conditioned - voiced stops never appear in coda positions. Kabak & Idsardi argue that this phonotactic constraint in Korean does not trigger illusory vowels, while constraints on contrastive phonological features (e.g., [strident], [spread glottis]) do trigger illusory vowels. In this paper, we show evidence contrary to this above claim.

Inspired by Bayesian models of speech perception (Feldman & Griffiths, 2007; Sonderegger & Yu, 2010), we claim that the task of the listener in speech perception is to identify the target production given information at multiple levels of representations – the acoustic level, the surface phonological level and the underlying phonemic/contrastive information. Therefore, both contrastive and non-contrastive phonological features are expected to trigger perceptual epenthesis in an illicit phonotactic environment, along with the phonetic characteristics of the language. We show that voiced stops in illicit phonotactic contexts in Korean do trigger perceptual epenthesis, just as contrastive phonological features. Therefore, the lack of effect in the original study could be a result of task-specific/stimulus-specific factors.

We ran an identification task on 16 native Korean speakers, and 23 native American English speakers as controls. We presented participants with pairs of nonce words of the form eC_1V_1ma [where, C_1 = p / b / d / t / k / g; V_1 = i / ɯ / Ø (Null)]. All the tokens had stress on the first vowel, and were natural recordings by a trained phonetician. For Korean speakers, we predict that the phonotactically illicit voiced stops in coda positions (e$C_{[voiced]}$ma) trigger illusory vowels to a much higher degree than voiceless stops in a similar syllabic context (e$C_{[voiceless]}$ma). The expected illusory vowel in such contexts is the *default vowel* [ɯ] (Durvasula & Kahng, 2012). In contrast, for English speakers, since both voiced and voiceless stops are licit in coda positions, we predict little to no perceptual epenthesis in such contexts.

Separate Repeated Measures ANOVAs for each language were run, with voicing, and place of articulation as factors. For the Korean participants, as predicted, there was a main effect of voicing [$F(1, 15) = 14.51$, $p = .002$, $\eta_p^2 = .49$]. In contrast, for the English participants, again as predicted, there was no significant main effect of voicing [$F(1, 22) = 1.00$, $p = .328$, $\eta_p^2 = .04$], thereby suggesting that the perceptual differences exhibited by the Korean participant were not driven by specific phonetic properties of the tokens themselves.

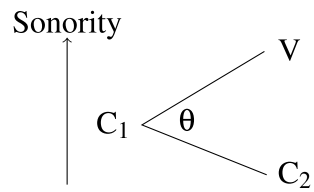
Contrary to Kabak and Idsardi (2007), phonotactically illicit voiced stops in Korean trigger more illusory vowels than their voiceless counterparts in the same environment. More generally, we show that the phenomenon of perceptual epenthesis (and by extension, speech perception) is also modulated by non-contrastive allophonic features.

The perceptual dimensions of sonority-driven epenthesis

Michelle Fullwood (Massachusetts Institute of Technology)
maf@mit.edu

Vowel epenthesis often appears to preferentially target consonant clusters with rising sonority. One explanation for this tendency is perceptual faithfulness (Fleischhacker 2002, Steriade 2006): rising sonority clusters are more susceptible to epenthesis because the perceptual distance between the underlying /C_1C_2/ sequence and its correspondent output sequence [C_1VC_2] is small, thus incurring a smaller faithfulness cost.

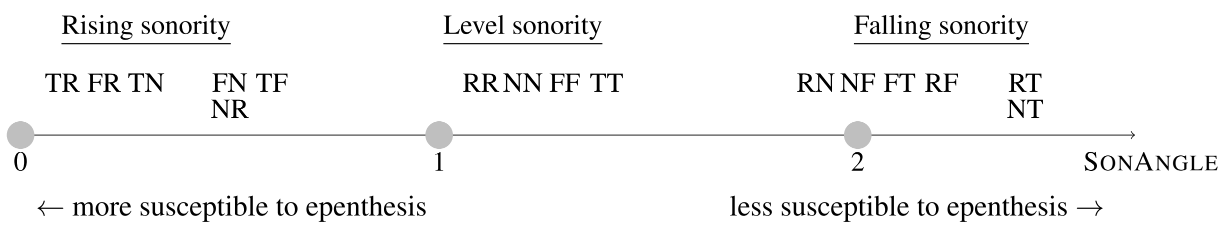
This raises the question of how to compute the perceptual distance between two sonority contours. I propose that the appropriate metric is the angle formed by C_1C_2 and C_1V.



(1) SONORITY ANGLE $= tan^{-1}(V - C_1) - tan^{-1}(C_2 - C_1)$

Given a standard sonority scale mapping classes of consonants to numerical sonority, this metric predicts the following hierarchy of susceptibility to epenthesis for consonant clusters.

(2) Scale of SONORITY ANGLE costs for a subset of consonant clusters.
T (stop) = 1, F (fricative) = 2, N (Nasal) = 3, R (Liquid) = 4. V (Vowel) = 6.



I present two case studies of sonority-driven epenthesis in Chaha (Ethiopia; Southern Semitic) and Irish (Celtic) that demonstrate the correctness of certain rankings of clusters in the hierarchy, in contrast with two alternative proposals: (i) SONORITY RISE, a metric proposed by Flemming (2008) that computes the faithfulness cost of epenthesis in terms of the ratio of the gradients of the sonority contours; and (ii) a markedness-based approach based on SYLLABLE CONTACT for heterosyllabic clusters (Murray & Vennemann 1983, Rose 2000) and SONORITY SEQUENCING for tautosyllabic ones. Across syllable boundaries and in codas, clusters with a more positive sonority distance *DIS (Gouskova 2002), computed as the sonority of C_1 minus sonority of C_2, are less marked and hence more resistant to epenthesis.

Specifically, SONORITY ANGLE predicts the following, in contrast to the other two theories:

(3) a. RN is the most likely falling sonority cluster to epenthesise (see (2)). SONORITY RISE predicts that FT and NF are more likely to epenthesise than RN. The *DIS-based approach predicts that all clusters with a +1 distance should be equally susceptible to epenthesis. In Chaha, only RN patterns with rising and level sonority coda clusters in undergoing epenthesis (Rose 2000), supporting the SONORITY ANGLE hypothesis.

b. NT and RT are the clusters least likely to epenthesise. SONORITY RISE and *DIS predict that if these clusters do not epenthesise, neither should RF. In Irish, NT and RT are the only sonorant-initial clusters not to undergo epenthesis, while RF does (Carnie 1994), once again supporting SONORITY ANGLE.

A rule selection deficit in Huntington's Disease patients: evidence from a morpho-phonological task

Maria Giavazzi (maria.giavazzi@gmail.com)
Institut d'études cognitives – Equipe NPI (ENS, Paris); INSERM U955

There is a lively debate in the recent literature about whether subcortical structures, in particular the striatum, hold a specific role in linguistic processing, or whether they contribute to it indirectly, through their role in executive functions (Friederici 2006; Mestres-Missé et al. 2012).

Huntington's Disease (HD) offers a unique model of primary atrophy of the striatum, with simultaneous decline in various cognitive functions. Language impairment in this disease has been described in the literature in a number of morphological and syntactic tasks (Teichmann et al., 2005, 2006, 2008, 2009; Nemeth et al. 2012; Sambin et al. 2012). Evidence is nevertheless scattered and the specific nature of the deficit has yet to be understood.

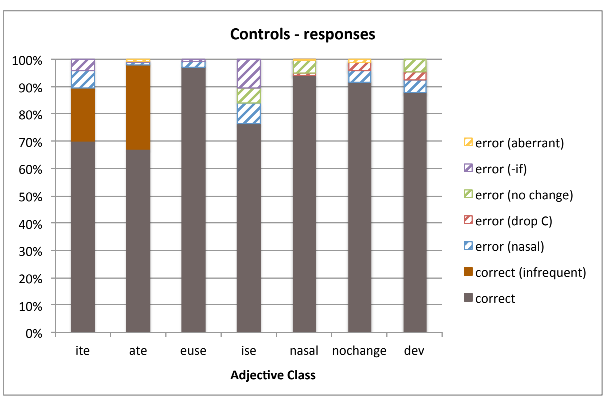
This paper investigates morpho-phonological knowledge of 42 French HD patients and 42 matched healthy control subjects. We carried out two experiments on gender variation in French adjectives (1). In Experiment 1, participants were given a variety of disyllabic nonce adjectives in the feminine form, and volunteered masculine forms. In Experiment 2, participants were asked to judge whether for a given nonce adjective, the feminine and masculine forms where correct or not.

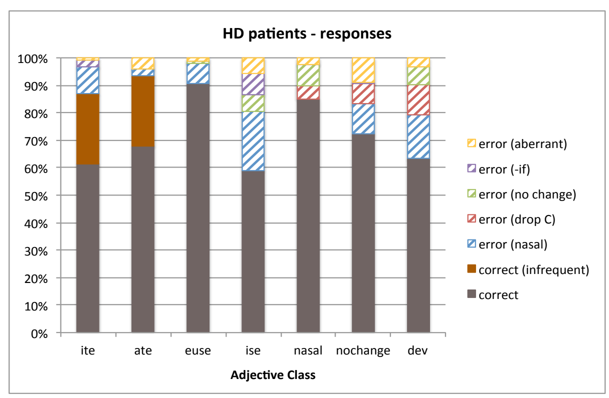
(1) Gender alternations in French adjectives

Type of alternation	**Fem. Sg.**	**Masc. Sg.**	**Gloss**	**nonce adjectives (Example)**
"No change"	[noʁmal]	[noʁmal]	'normal'	fem. [stʁynal] – masc. [stʁynal]
"Final C deletion"	[pətit]	[pəti]	'small'	fem. [zamit] – masc. [zami]
"Final devoicing"	[spoʁtiv]	[spoʁtif]	'sporty'	fem. [məʁiv] – masc. [məʁif]
"Vowel nasalization"	[bʁyn]	[bʁœ̃]	'brown'	fem. [laldin] – masc. [laldɛ̃]

Results from Experiment 1 show that controls are able to extract and use the morphological rules of their language to produce the masculine forms of nonce words. HD patients on the contrary over-apply those rules which apply to a large number of adjectives in the lexicon, making errors on those words whose phonological properties require the application of a more restrictive rule (2).

(2)





We propose a morpho-phonological analysis of the productions of both populations, which makes use Albright and Hayes's (2003) rule-based model of how speakers extend morphological patterns of their own language to nonce words (MGL). We show that the deficit in HD patients arises from the difficulty to detect the appropriate context in which a morphological rule should apply. This yields to using the rules with the highest probability of being correct, i.e. the ones which correctly apply to a large number of adjectival forms in the lexicon. Results from Experiment 2 provide further support to this analysis, showing that even in a grammaticality judgment task, patients are less likely to detect violations, if the rule used incorrectly is one that applies to a large set of real words.

We show that this characterization of the patients' deficit allows us to better understand previous descriptions of their morphological deficits in the verbal and in the nominal domain. Our analysis also allows us to discuss this deficit in the wider context of the role of the striatum in language processing and in mechanisms of cognitive control.

Constraints on Branchingness

Ben Hermans; Meertens Institute; ben.hermans@meertens.knaw.nl

Outline. We argue, following Dresher and van der Hulst (1998) (henceforth D+H), that Branchingness is a crucial concept of phonology. The constraints regulating the distribution of Branchingness replace, among other things, NON-FINALITY and WINDOW.

The problem. Hyde (2007) proposes a family of NON-FINALITY constraints that account for a variety of phenomena. NON-FINALITY consists of three arguments that can be varied. In (1) one instance of this family is formulated, in which the arguments are x_F, μ and σ. This instance accounts for Stress-to-Weight and Rhythmic (Trochaic and Iambic) Lengthening.

(1) NON-FIN(x_F, μ, σ): No foot-level gridmark (GM) occurs over the final mora of a syllable.

	a)	b)		c) FINALWINDOW
(2)	x	x	foot-level GM	
	x x	x x	mora-level GM	$*\langle x_\omega, F\rangle$ / ω
	$(\mu)_\sigma(\mu)_\sigma$	$(\mu\ \mu)_\sigma$	moras + syllables	$x_\omega\ \sigma\ F$

In (2a) the foot-stress occupies the final mora in a syllable, violating (1). In (2b), however, it is located on the non-final mora of a syllable, because this syllable is heavy (bimoraic). Now NON-FIN(x_F, μ, σ) is not violated. This constraint, then, explains why stressed syllables tend to be heavy, accounting for Stress-to-Weight and Lengthening. Interestingly, Hyde's NON-FINALITY can*not* explain extrametricality, no matter which arguments are chosen. This is unsatisfactory, because NON-FINALITY was designed by Prince and Smolensky (1993) to replace extrametricality. Thus, to account for antepenult stress Hyde (2008) proposes the WINDOW constraint in (2c). Notice that it is formally unrelated to Hyde's NON-FINALITY.

The proposal. D+H propose a constraint *requiring* Branchingness of *foot heads*. This is the equivalent of (1), in the sense that it accounts for the same phenomena. Another type of constraint in D+H forbids the cumulation of Branchingness in a constituent. It implies that a constituent may not branch if its head branches. It therefore penalizes an uneven trochee, among other things, as shown in (3a) (brackets indicate hierarchical structure). This foot is both unmarked (its head branches) and marked (it cumulates Branchingness).

(3) a) uneven trochee $((\mu\ \mu)_\sigma\ (\mu)_\sigma)_F$ b) main stress constituent (MSC). $((\sigma\ \sigma)_F\ (\sigma))_{MSC}$

We propose that in languages where main stress is assigned at the right a left dominant MSC is constructed, aligned with the word's right edge (the mirror image holds if main stress is assigned at the left). Like any constituent the MSC is subject to the constraint against Branchingness cumulation. If it is low ranked we get an uneven trochee, but one level higher up, as shown in (3b). Antepenult stress, then, is created by low ranking of the constraint against Branchingness cumulation in the MSC, allowing it to contain three syllables. In sum: there is no NON-FINALITY and there is no WINDOW. We rather have a requirement on branching heads, and a constraint against the cumulation of Branchingness. If the latter constraint is low ranked at the foot level, we get an uneven trochee. If it is low ranked at the MSC-level, we get antepenult stress. On top of that we can also account for Weight-to-Stress, a phenomenon that cannot be accounted for by NON-FINALITY, nor by WINDOW. Weight-to-Stress is an instance of a family, proposed by D+H, that *disallows* Branchingness in a constituent's *dependent*. Constraints on Branchingness, then, give a uniform account of a multitude of phenomena (extrametricality, Stress-to-Weight, Lengthening, Weight-to-Stress, postpeninitial stress and the markedness of uneven trochees). Let us therefore return to 1998.

Contour segments and tones in phase-based Agreement by Correspondence

Sharon Inkelas
University of California, Berkeley
inkelas@berkeley.edu

Stephanie S Shih
Stanford University | University of California, Berkeley
stephsus@stanford.edu

Phonological theory has long been challenged by the behavior of contour segments and contour tones in harmony patterns. Sometimes these entities participate in phonology as whole units; at other times, their subsegmental parts act independently. This paper builds on insights from Autosegmental Theory (Goldsmith 1976), Aperture Theory (Steriade 1993), and Articulatory Phonology (Browman and Goldstein 1989; Gafos 2002) to propose a novel phonological representation for segments: all segments, including contours, are subdivided into a maximum of three ordered subsegmental phases that host unitary sets of distinctive features and can participate in harmony (and other processes). These phases, shown with superscript numbers in (1), correlate with closure, target, and release phases in consonants and CV/VC transitions and targets in vowels.

(1)	Vowel with triple tone contour	V(à^{1} á^{2} à^{3})	e.g., Mende *mbà*ˆ ‘companion’
	Pre- and post-aspirated plosive	C(h^{1} k^{2} h^{3})	e.g., Kashaya *^{h}k^{h}uy* ‘burn’ (Buckley 1992)
	Prenasalized consonant	C(n^{1} d^{2} d^{3})	e.g., *^{n}d*
	Aspirated affricate	C(t^{1} ʃ^{2} h^{3})	e.g., *ʧ^{h}* (see (2b) below)

By incorporating these representations in Agreement by Correspondence (ABC; Hansson 2001; Rose and Walker 2004; a.o. for segmental ABC; Shih 2013 for tonal ABC), we can offer, for the first time, a united treatment for the behavior of both contour segments *and* contour tones across observed phonological patterns of harmony.

In this paper, we present a typological overview showing that contours can participate in harmony as units and as subsegmental phases. Table (2) provides representative examples:

(2)

Whole contour effect: all phases participate	**Partial contour effect: some phases participate**
a. Ngbaka nasal co-occurrence restrictions (Rose and Walker 2004): [^{m}bɛɛ̀^{m}bɛ] ‘snail’, [nɑnɛ̀] ‘today’; *^{N}C…C, *C…^{N}C	b. Samala (Ineseño Chumash) sibilant harmony (Applegate 1972, Hansson 2001): /s-api-tʃ^{h}o-it/ → [ʃapitʃ^{h}olit] ‘I have a stroke of good luck’
c. Changzhi whole contour tone copying (Yip 1989; Duanmu 1994): /kuə$_{213}$ -tə$^{ʔ}{}_{535}$/→ [kuə$_{213}$ -tə$^{ʔ}{}_{213}$], ‘pan, dim.’	d. Hakha-Lai partial contour tone agreement (Hyman and VanBik 2002): /thlaâŋ + zuû/ → [thlaâŋ zuù] ‘mountain beer’

In phase-based ABC, whole contour effects, as in (2a, c), are captured by correspondence at the segment level: CORR-segment. Because the vowel in Changzhi *kuə$_{213}$* is a unit, CORR-segment-V and IDENT-XX (tone) correctly predict the tonal contour assimilation that occurs in diminutivization (2c): /ku(ə$_{2}$ ə$_{1}$ ə$_{3}$)-t(ə$_{5}$ ə$_{3}$ ə$_{5}$)^{ʔ}/→ ku**(ə$_{2}$ ə$_{1}$ ə$_{3}$)$_{i}$** -t**(ə$_{2}$ ə$_{1}$ ə$_{3}$)$_{i}$**^{ʔ}. Partial contour effects (e.g., (2b, d)) are captured by correspondence at the phase level: CORR-phase. In Hakha-Lai (2d), CORR-phase-V puts the last phase of the first vowel in correspondence with phases of the subsequent vowel. IDENT-XX (tone) forces agreement of Low tone across the phases in correspondence: /thla(á à à)ŋ zu(ú ù ù)/ → thla(á à **à$_{i}$**)ŋ zu(**ù$_{i}$** ù ù). As in standard ABC, corresponding entities must meet a prescribed similarity threshold: e.g., both are vowels, sibilants, etc.

Autosegmental theory can handle some partial contour behavior but not whole contour behavior (e.g., Duanmu 1994). Standard ABC, with representations that go no deeper than the segment, easily handles whole contour behavior but has hitherto had serious trouble with partial contour patterns. In phase-based ABC, all segmental and tonal contours deconstruct into a series of simplex phases. Phase-based ABC provides a principled and functionally-motivated method for referencing subsegmental material in both segments and tone that does not rely on stipulating differences in featural representations and geometry, thus increasing the descriptive and explanatory adequacy of the theory.

Non-contrastive epenthetic segments as surface prosodic structure

Pavel Iosad
University of Ulster p.iosad@ulster.ac.uk

In this paper I offer an analysis of some cases of predictable epenthesis which involve segments absent from the contrastive inventory of the relevant language. I suggest that these phenomena are best analysed via the attachment of features directly to prosodic nodes and that they do not represent serious counterexamples to the Contrastivist Hypothesis (Hall 2007; Dresher 2009). Moreover, this analysis adds to the body of evidence regarding contrastive prosodic structure in surface representations.

Prosodically driven epenthesis in many languages involves segments that are not part of the contrastive inventory, such as [ʔ] in a language like German. This appears to be a challenge to approaches that excise non-contrastive information from the phonology, since such epenthesis is normally sensitive to purely phonological factors such as prosody. Here, I argue that this type of epenthesis can (at least in some languages) be analysed without reference to the segmental inventory.

In southern dialects of Scottish Gaelic (Holmer 1938, 1962; Ternes 1980), a glottal stop may follow a stressed short vowel; Smith (1999) analyses this as epenthesis driven by a stress-to-weight requirement.

(1) [ˈkʰa$_\mu$*(ʔ$_\mu$)raxəɣ] *caraich* ‘move’

Crucially, data adduced by Jones (2000) show that this is not merely a fact about static distribution, because postlexical resyllabification can lead to alternations:

(2) a. [ˈfɛ(*ʔ)n lɛm] *fan leam* ‘stay with me’
b. [ˈɣɛʔn ɑ] *dh’fhan e* ‘he stayed’

I suggest that the pattern results from a feature attaching to the second mora of the stressed syllable. That mora is projected to satisfy stress-to-weight but remains segmentally empty (i. e. it does not dominate a root node). Importantly, syllable boundaries (and thus sites for mora insertion) appear to be lexically contrastive in the relevant Scottish Gaelic dialects (e. g. Ladefoged 2003).

This analysis predicts that a language may have a contrast between two types of morae directly associated with a feature: those that dominate a root node and those that do not. I argue that Zealand Danish presents just such a contrast. Ejskjær (1967, 1970) shows that in these varieties the common Danish *stød*, itself argued to be associated with bimoraicity (Grønnum and Basbøll 2001; Basbøll 2005), coexists with the so-called ‘short-vowel *stød*’ (*kortvokalstød*):

(3) a. [ˈbrøːˀgʌ] *brøker* ‘fractions’
b. [ˈbrøˀgʌ] *brygger* ‘((s)he) brews’

I argue that ‘short-vowel *stød*’ appears where a second mora, introduced by prosodic and/or morphological means, cannot be associated with a vowel (because that vowel is short) or a sonorant (because ambisyllabicity is disallowed). I show that this analysis requires contrastive prosodic structure in surface representations (e. g. Köhnlein 2011; Morén-Duolljá 2013): cf. [brøˀgʌ] ‘((s)he) brews’ with [ˈbrøgʌ] ‘brewer’. This type of *stød* contrasts with common Danish *stød*, driven by the addition of a glottalization feature to a mora projected by a segment (a long vowel or a sonorant).

Thus, the ‘glottal stop epenthesis’ seen in Scottish Gaelic and Zealand Danish does not involve the use of a noncontrastive segment by the phonology, upholding the contrastivist hypothesis. Moreover, the data adduced here indicate that non-tonal features may attach to prosodic constituents (Kehrein and Golston 2004) and that lexically contrastive syllabification is possible (Vaux 2003, *pace* e. g. McCarthy 2007, §3.2.4.1).

Synchrony *vs.* diachrony: the case of Ancient Greek *r*

Adèle Jatteau
Université Paris 8-ENS
a.jatteau@gmail.com

1. Overview. This communication defends the claim that Ancient Greek (AG) word-initial *r* is a non contrastive geminate. In §2, we provide three arguments to sustain this hypothesis. But a word-initial geminate in AG is a problem, given what we know of the system of the language (§3). We propose a synthesis and a formalisation of previous, diachronic approaches to the question and show that it cannot account for the data in §2 in the synchrony of AG, thus supporting the claim that a synchronic approach is required (§4). We provide further evidence from the philological literature to show that word-initial geminates were more developed in a past stage of AG, and that *rr-* can be understood as the last geminate resisting simplification (§5).

2. Data. Although the normal ancient orthography does not account for it - except for a few exceptions in epigraphic documents -, three arguments support the claim that AG word-initial *r* (historically *sr-, wr-* initials) is an actual geminate (Steriade 1982, Seigneur-Froli 2006). First, in the meter of comedy and tragedy, which are considered to be close to the spoken language, word-initial *r*'s must often be counted as clusters, preferably within closely-knit sequences (Stephens 1990): *ta (r)rēmata* ¯ ¯ / ˘ ˘ (article + noun, Aristophanes *Frogs* 1059). Second, in morphology, adding a "prefix" – first member of compound or a tense marker *e-* vowel – to a *r*-initial word "turns" it "into" a geminate: *reō* "to flow", imperfect *e-rreon*, compound *epi-rreō* "to float". The morphology of the perfect tense, finally, is especially revealing. While verbs beginning with a consonant or with a *muta cum liquida* cluster (tautosyllabic in Classical Attic) form the perfect tense through reduplication (*luō*, pft. *le-luka* "unbind"; *pneō*, pft. *pe-pneuka* "blow"), verbs beginning by otherwise heterosyllabic clusters take a simple *e-* prefix: *speudō*, pft. *e-speuka* "hasten", *ptēssō,* pft. *e-ptēk*^{h}*a* "scare". Now, *r*-initial verbs form the perfect tense with the *e-* prefix, as if they began with a heterosyllabic cluster: *reō*, pft. *e-rruēka*.

3. Problem. A straightforward explanation of these facts is the following: AG word-initial *r* is a non contrastive geminate. This raises at least three problems. First, word-initial geminates are very marked objects. It is surprising that AG should have one, and *a fortiori* only one. Second, languages allowing for word-initial geminates usually maintain the contrast C ~ CC word-initially (Muller 2001, Davis 1999). AG has a length distinction for most of its consonants, and it is suprising that *r* does not contrast in one position. Third, non distinctive "strong" *r*'s are frequent word-initially across languages (Bradley 2001), as in Ibero-Romance. But they are not phonological geminates: Spanish for example does not have a length distinction, and its word-initial trill is usually not phonologically analysed as a geminate. All these objections question the interpretation we gave of the data in §2.

4. Discussion. Previous literature on the subject (Magnien 1920-22, Allen 1968 [1987], Lupaş 1972, Lejeune 1972), except for Steriade (1982) and Seigneur-Froli (2006), rejects the word-initial geminate hypothesis and proposes a diachronic explanation: gemination arises from historical *sr-, wr-* clusters *only* after short vowels and at the morpheme boundary, including both morphological boundaries (*e-rreon, epi-rreō*) and word-boundaries within tight sequences such as clitic + *r*-initial word. We propose a synthesis and a formalisation of the philological literature to show that diachronic explanations are not sufficient to dismiss our claim that in synchrony, word-initial geminate *r* is the default case.

5. On the other hand, we highlight data from the metrics of Homer and the morphology (Schwyzer 1939, Chantraine 1958, Lejeune 1972) which suggest that at a former stage of AG, all the sonorants and *s* could be geminates word-initially. We argue for a scenario in which the isolated *rr-* is a reminiscence of this previous stage, in which word-initial geminates were much more frequent. Under this view, word-initial *r* displays a greater resistance to simplification than other sonorants, thus confirming the implicational scale evidenced for Ibero-Romance sonorants by Carvalho (1989).

Drifting without an anchor: how a pitch accent withstands vowel loss

Evia Kainada, Mary Baltazani
University of Ioannina, Greece
ekainada@cc.uoi.gr, mbaltaz@cc.uoi.gr

In the phonological theory of intonation, *segmental anchoring* refers to the rule-governed alignment of pitch accents with specific targets in the segmental string (Arvaniti et al. 1998, Auer et al. 2000, Schepman et al. 2006). The nature of segmental anchoring is controversial. Proposals have been made for its *phonetic* nature, specified by dialect/language-specific implementation rules (Arvaniti &Garding 2007, Ladd et al. 2009); counter-proposals invoke a *phonological* secondary association of tones with syllable/segment edges (Ladd et al. 2000, Prieto & Torreira 2007). Our paper aims to contribute to this debate using a Northern Greek (NG) dialect as the empirical basis of argumentation.

The L*+H pitch accent in Standard Modern Greek (SMG) aligns the L tone near the consonant onset of the stressed syllable and the H tone just after the onset of the post-accentual vowel (C0 and V1 respectively, Fig. 1a; Arvaniti et al. 1998). This alignment pattern cannot resolve the issue of the phonetic vs. phonological nature of segmental anchoring, as both proposals are compatible with the empirical evidence. If we hypothesize a similar alignment of the L*+H in NG, a very interesting observation arises, relating to the process of unstressed high-vowel deletion in NG (i.e., /ma'loni/→ [ma'lon] ‘scolds’; Topintzi & Baltazani 2012). High-vowel deletion can sometimes deprive the H tone of its putative anchor point, the post-accentual vowel (V1, Fig. 2top). The way the pitch accent faces such loss can shed light to the nature of segmental anchoring: a phonological account, as spelt out above, predicts primarily that the H tone will seek the next available vowel edge to dock onto (among other predictions that will be discussed in this paper); a phonetic account might allow for more gradient solutions. To resolve this question we conducted a production experiment.

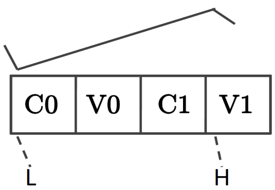


Figure 1. Typical alignment of L*+H

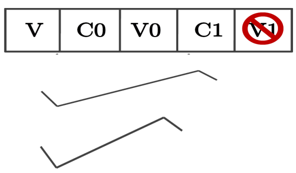


Figure 2. First post-accentual vowel deletion (top); L*+H alignment, C1=sonorant (middle); L*+H alignment, C1=obstruent (bottom)

Five NG speakers in a semi-directed speech task, produced 20 sentences with words potentially involving deletion of V1, matched with 20 sentences without deletion. L*+H in NG, as hypothesized, had similar alignment to that in SMG (Fig. 1a): on average, the L aligned 5ms into C0 and the H 4ms intoV1. On the other hand, in deletion environments, the L aligned earlier (10ms before C0), while the H, interestingly, drifted depending on the sonority of C1. More specifically, the H appeared well into C1 with sonorants (on average 30ms after the consonant’s onset), while with obstruents it aligned on average 10ms *before* the consonant’s onset (Fig. 2 mid and bottom respectively). Taken together, our results indicate that when the docking site is deleted, the H seeks the closest available sonorant candidate, mirroring a phonetic reflex rather than a phonological rule. A hypothesis of a phonologically specified secondary association would predict a complete change in the H alignment pattern in order to anchor with the edge of the first available phonological target.

The results of this study contribute to the existing literature on cross-dialectal variation showing that even when two varieties have the same phonological category (i.e. pitch accent), they can differ in its fine-grained phonetic realization. In addition, such subtle differences

Maximal Prominence in Positional Licensing

Aaron Kaplan
University of Utah
a.kaplan@utah.edu

This paper develops a refinement of positional faithfulness and positional licensing to account for an asymmetry in the kinds of phenomena those theories produce. These theories account for the exceptional behavior of prominent positions like stressed syllables: hosting more contrasts, resisting otherwise general processes, or triggering assimilation. Such patterns fall into two groups: (i) the prominent position remains faithful while other positions neutralize or assimilate (*preservation* systems) and (ii) the prominent position acquires a feature from some other position so as to provide a more robust host for that feature (*overwrite* systems).

These groups are asymmetrical: the positions that serve as prominent in preservation systems appears to be a superset of those that serve as prominent in overwrite systems. A variety of positions exhibits phonetic or cognitive properties that lend them prominence. These include stressed syllables, initial syllables, roots/stems, and final syllables (e.g. Walker 2011), all of which behave as prominent in some preservation system: stressed syllables resist reduction in English, short *e, o* are confined to initial syllables in Tamil (Christdas 1988), clicks appear only in roots in Zulu (Beckman 1994), and Pasiego Spanish restricts its tense/lax contrast to final syllables (Barnes 2006). However, only stressed syllables, initial syllables, and roots/stems behave as prominent in overwrite systems (Barnes 2006, Walker 2011): [+high] spreads to the stressed syllable in Central Veneto (Walker 2011), vowel features migrate to the initial syllable in Esimbi (Hyman 1988), and ATR spreads to the root in Lango (Kaplan 2008). No comparable example exists for final syllables, where some element spreads or moves to that position specifically. Similarly, secondary stress and pretonic vowels can be targeted for preservation (e.g. in resisting vowel reduction; Crosswhite 2001), but Walker's (2011) extensive survey of overwrite systems includes no language in which an element moves or spreads to either of these positions.

The generalization, I argue, is that overwrite may target only maximally prominent positions. For each position that participates in preservation but not overwrite, there is some other position that is more prominent on the relevant dimension: in terms of metrical prominence, secondary stress and pretonic syllables are less prominent than primary stress, and in terms of linear order, initial syllables are more prominent than final syllables because the latter show evidence of weakness (decreased amplitude, e.g.; Barnes 2006) that the former do not.

This restriction on overwrite reflects a restriction on positional markedness. Both positional faithfulness and positional markedness produce preservation, but only positional markedness can produce overwrite (Zoll 1998). Licensing-based theories of positional markedness (e.g. Walker 2011) provide constraints of the form $\text{LICENSE}(\lambda, \pi)$ which restrict an element λ to the position π. I present a revision to this formalism that requires π to be maximally prominent. Thus $\text{LICENSE}(\lambda, \sigma_{Final})$, e.g., is disallowed, and since only positional licensing produces overwrite, an overwrite system targeting final syllables is impossible. But positional faithfulness may target non-maximally prominent positions—$\text{IDENT-}\sigma_{Final}$(ATR), e.g., is permitted—and preservation systems targeting final syllables, secondary stress, etc., can be generated.

This proposal has several desirable consequences. First, it explains the asymmetry between preservation and overwrite systems. It also fills a gap in theories of positional markedness and faithfulness: while constraints within these theories are often explicitly restricted to targeting prominent positions, what counts as prominent typically remains unformalized. Finally, the proposal addresses a redundancy in phonological theory. The empirical domains of positional markedness and positional faithfulness overlap significantly, but we can't discard either because each accounts for patterns that the other cannot (Beckman 1999, Zoll 1998). By restricting positional markedness to maximally prominent positions, we distinguish the theories further and identify an empirical domain—preservation in non-maximally prominent positions—that could potentially be produced by either theory but must in fact be the result of positional faithfulness.

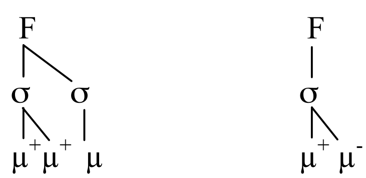
Towards a unified analysis of tone accent oppositions in Franconian and Scandinavian

Björn Köhnlein, Leiden University, b.koehnlein@hum.leidenuniv.nl

The issue. For both Franconian and Scandinavian, there is a growing debate on the phonological characteristics of the local tone accent systems. The 'traditional' assumption in autosegmental phonology is that the binary oppositions derive from the presence of pre-specified tonal information in the lexicon (cf. work by Bruce, Gussenhoven, Kristoffersen, Lahiri et al., Peters, Riad, etc.). Recently, however, the contrasts have also been analyzed as metrical oppositions (e.g. Hermans 2009; Kehrein to appear; Köhnlein 2011 for Franconian; Morén 2005, 2007 for Scandinavian). While the latter analyses thus all share the basic idea that there are no tones in the lexicon, the concrete implementation differs in terms of representations and the structure of the grammar. Building on the insights from these proposals, we argue that the approach developed in Köhnlein 2011 for Franconian can be extended to Scandinavian, resulting in a unified analysis.

Representational assumptions. Taking Franconian Rule A and Rule B (with reversed contours in declaratives and non-reversed ones in interrogatives) and four Scandinavian varieties with different surface contours for the accents (North Gudbrandsdal, Oppdal, Urban Eastern Norwegian; Stockholm Swedish) as examples, we show that the respective binary oppositions all derive from contrasts between syllabic and moraic trochees; the structures are as follows:

(1) Syllabic trochee Moraic trochee



In syllabic trochees, the first *syllable* is the head of the foot, and the second syllable is the dependent. The two moras in the accent syllable are both dominated/licensed by the foot head, which makes them metrically 'strong' at the foot level (they are in the *head domain* of the foot, indicated by superscript pluses). In the moraic trochee, on the other hand, the first *mora* is the head, and the second mora is the dependent – as the second mora is thus neither a foot head, nor licensed by a foot head, it is metrically 'weak' (superscript minus).

Structure of the grammar. The interactions between tones and metrical representations are regulated by OT constraints enforcing the realization of tones in prominent positions (e.g. $T \rightarrow u^+$, see Anttila & Bodomo 2000) vs. constraints that prohibit the realization of low tone in prominent positions (e.g. $*\mu^+/L$), along the lines of de Lacy (2002).

Analysis. Franconian Accent 2 and Scandinavian Accent 1 are moraic trochees, Franconian Accent 1 and Scandinavian Accent 2 are syllabic trochees. These representational differences lead to diverse tonal mappings within dialects and thus create the tonal surface contrasts; cross-dialectal tonal variation results from the ranking of constraints. While the differences between Franconian Rule A and Rule B can be attributed to a reranking of $T \rightarrow u^+$ and $*\mu^+/L$, our analysis for Scandinavian is inspired by work of Kristoffersen (2006, 2007) on the Norwegian varieties in question. Like Kristoffersen, we argue that the tonal contrasts arise from differences in the timing of intonational melodies. Yet Kristoffersen's approach relies on the assumption of a lexically pre-linked intonational (and thus *post*-lexical) tone, a problem that Kristoffersen acknowledges himself (2007:fn.13). Following the account presented in this paper, the problem disappears. As the timing differences derive from the diverse metrical representations, the current analysis makes pre-linking of tones superfluous.

On lexical tone and the nature of features

Ross Krekoski, **University of Toronto**

The question of whether lexical tone can be represented with features, and the concomitant issue of their specific theoretical nature, is a controversial topic that has garnered some recent interest from a fairly diverse range of viewpoints (Barrie 2007; Clements et al. 2011; Hyman 2010; Odden 2010). This paper shows that the inventories and comparatively rich sandhi paradigms in Beijing and Tianjin Mandarin, and the related Jin language of Pingyao are predicted by a contrastive hierarchy of features that is afforded by the framework associated with the Contrastivist Hypothesis (Dresher 2009; Hall 2007) which states that only contrastive features are phonologically active. I argue that the position that features can not be universally applicable to tone (Clements et al. 2011; Hyman 2010) is the inevitable consequence of assuming, at some level, some static predetermined relationship between specific acoustic cues or articulatory gestalts and a closed set of universal features. I propose an alternative conceptualization of features as dyadic mappings of phonologically abstract categories containing only the hierarchical arrangement of contrastive specifications onto phonetic correlates. This proposal resolves these issues and provides interesting insights into the synchronic and diachronic behaviour of tonal systems.

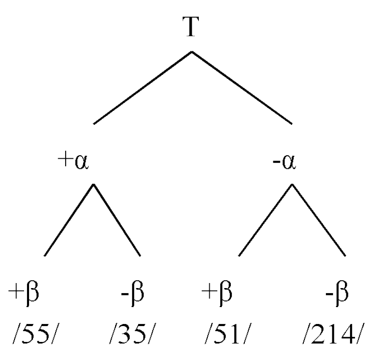
The approach is taken to initially investigate only phonological activity to motivate the construction of hierarchies, after which phonetic feature labels can be applied. For example, Beijing Mandarin (below) exhibits a dissimilatory sandhi that changes tone /214/ to /35/ before a second tone /214/. On the assumption that sandhi processes involve the change of a single feature, a feature tree can be deduced based on the total inventory of processes in each language.

This paper also reports on the finding that in Beijing Mandarin and Pingyao, the corresponding tonal categories in each language with the same set of cognates in Middle Chinese also possess the same feature specifications and hierarchical arrangement. Despite the fact that each language exhibits highly disparate sets of respective sandhi processes, and that the tones themselves take drastically different phonetic shapes in both languages (e.g. /35/ in Pingyao corresponds to /51/ in Beijing [-α +β], and /53/ in Pingyao corresponds to /214/ in Beijing [-α -β]), it is found that they pattern in formally analogous ways, and contrastive feature representation predicts the allowable range of possible sandhi processes in both languages.

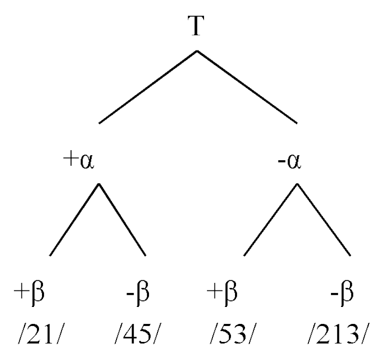
Tianjin Mandarin represents an interesting and more nuanced case. While each tonal category in Tianjin also corresponds one-to-one with a respective category in Beijing and Pingyao and a set of Middle Chinese cognates, activity patterns show that Tianjin underwent a contrastive reanalysis of features. In a reconstruction of proto-Tianjin (below), none of the two low tones, /213/ and /21/, nor the two high tones /53/ and /45/, shared any features, precipitating a reanalysis whereby the modern Tianjin hierarchy represented a phonetically natural, less computationally difficult learnability alternative to Proto-Tianjin. (/53/ → [+α +β] and /21/ → [-α +β])

The data motivates the argument that only contrastive feature specification and the hierarchical relationships between categories determine phonological patterning synchronically, without reference to phonetic manifestation and that while contrastive hierarchies represent a comparatively stable structural skeleton, that diachronic reanalysis, when it does occur, is phonetically motivated.

Modern Beijing Mandarin



Proto-Tianjin



Nasal Harmony with Opaque Segments and Learnability: Evidence from Wug Tests

Yu-Leng Lin
Department of Linguistics, University of Toronto <yuleng.lin@mail.utoronto.ca>

Walker (2011) proposes a universal implicational nasalized segment constraint hierarchy based on evidence from typological frequency, namely vowels > laryngeals > glides > liquids > fricative > obstruent stops. She draws evidence for this hierarchy from nasal harmony systems, arguing that in a language, if a more marked manner class blocks harmony (with vowels the least likely to be blockers), so do the less marked classes (obstruent stops are the most likely to be blockers). In recent work, artificial grammar learning (e.g., Lin 2010, Moreton 2008, Reber 1989, Wilson 2003) has been used as a methodology to test markedness. This study uses artificial grammar learning to test for the interaction between the implicational universal sonority hierarchy, a gradient scale, and nasal harmony (a type of assimilation), an innovative use of artificial grammar learning (see Moreton & Pater 2012 a, b). In the study, I address whether a pattern that is predicted by the implicational scale is easier to learn than a pattern that is not predicted. More particularly, I use a grammaticality judgment wug test to investigate whether it is easier to make a generalization when a more marked blocker is presented during familiarization and a less marked blocker in testing rather than vice versa, trying to make artificial grammar learning more like natural language learning.

To test the nasalized segment constraint hierarchy between fricatives and stops, I conducted an experiment with two groups who speak Taiwan Southern Min. Group 1 participants learned [s] as a blocker during the study phase, and were tested on whether they generalized to [k] as a blocker. If the predictions of the hierarchy are correct – blocking by the more marked fricative implies blocking by the less marked stop – participants are expected to treat stops as blockers even though they were not presented in the study phase. Group 2 participants were exposed to [k] as a blocker and were tested on [s]. Participants were not expected to generalize from [k] as a blocker to [s] as a blocker since blocking of [k] does not imply blocking of [s].

The analysis compared Group 1 with Group 2. The results show no significant differences between Group 1 and Group 2. These results are surprising if [k] is a stop and [s] is a fricative. We expect that the blocking of [k] would be less marked than the blocking of [s]. However, the results suggest that [k] and [s] are equally marked.

In order to understand this puzzle, I tested another voiceless fricative [h] to see if a learning asymmetry occurred between [h] and [k]. Two other grammars were generated (Group 3: exposed to [h] as a blocker and tested on [k]; Group 4: vice versa).

The analysis compared Group 3 with Group 4 and the results show that there was a significant difference between these groups in the direction expected (the former was better than the latter).

These results can be reconciled with the hierarchy. For [k] and [s], Clements (1990) argues that languages can differ in whether obstruents are treated as a class or are more finely differentiated. If obstruents are a single class, it follows that there would be no significant difference between groups 1 and 2 with respect to learning. Second, the status of [h] as an obstruent or a sonorant has been debated (e.g., Mielke 2007, Olson and Schultz 2002, Vaux & Miller 2011). If [h] is an obstruent, one would expect no significant difference between [s] and [h] in terms of their patterning with respect to [k]. However, if [h] is a sonorant, the difference between groups 3 and 4 is expected.

The current results raise the possibility that that the proposed universal implicational nasalized scale might involve just a two-way opposition, namely sonorants > obstruents, with finer gradations learned based on exposure to a language rather than innate. This is an important issue in phonological theory – just how much is built in, and what emerges through language acquisition?

Non-intervention constraints and the binary-to-ternary rhythmic continuum

Violeta Martínez-Paricio[⁎] & René Kager[*]
([⁎]CASTL-University of Tromsø, [*]Utrecht Institute of Linguistics-OTS, Utrecht University)

Ternary rhythm, the phenomenon by which stress is placed on every third syllable, has been reported for a small number of languages including, among others, Cayuvava (Key 1967), Chugach Alutiiq (Leer 1985ab), Tripura Bangla (Das 2001) and Estonian (Hint 1973). Although typologically rare, any theory of stress must provide an adequate account of ternary rhythm. However, this task has proved extremely challenging. In fact, previous constraint-based analyses of binary and ternary rhythm all suffered from undergeneration (i.e. they cannot generate the full attested typology of stress systems) and/or from pathological overgeneration (i.e. they predict ungrammatical patterns such as the *midpoint pathology*, Eisner 1997).

Importantly, recent research has demonstrated that this and other pathologies are intrinsic to gradient alignment constraints (Eisner 1997, Kager 2001, 2005, McCarthy 2003, Buckley 2009) and lapse licensing constraints (Kager 2012). However, since constraints of these types seemed indispensable in capturing directionality effects in stress systems (i.e. they control edge-oriented distributions of feet or lapses within the prosodic word), it remains an unresolved conundrum how to generate the full typology without using gradient and/or lapse licensing constraints. In order to solve this puzzle, this paper presents an alternative analysis of quantity-insensitive binary and ternary systems, which only employs a small set of categorical alignment constraints of the 'non intervention' type (Prince 1983, McCarthy 2003, Houghton 2006, Hyde 2012). By means of a computer-generated factorial typology (OTSoft 2.1, Hayes et al. 2003), we can prove that the present analysis correctly generates the full typology, while avoiding the introduction of pathological patterns.

Interestingly, a careful investigation of an updated typology of binary and ternary systems reveals there is no clearly defined boundary between *strictly binary* and *strictly ternary* systems. Building on recent research which presents compelling evidence for maximally ternary feet with internal binary-branching structure in languages without ternary rhythm (Bennett 2012, Kager 2012, Martínez-Paricio 2012), we argue that binarity and ternarity naturally co-exist in rhythmic systems. In particular, we propose that quantity-insensitive rhythmic systems form a binary-to-ternary continuum. At one end of the continuum, we find languages with mostly maximal binary feet, which exhibit a peripheral maximal ternary foot in odd-parity forms only in order to ensure exhaustivity (Martínez-Paricio 2012) (e.g. (a) in Table 1). At the opposite end of the continuum, there are languages such as Cayuvava, where feet are obligatorily ternary, even if a binary foot could ensure exhaustive parsing of two adjacent weak syllables ((d), Table 1). Finally, in between the extremes, we find languages such as Estonian and Tripura Bangla, the former showing a greater degree of binarity than the latter (compare 4-σ words in (b) & (c) below):

Table 1	a. Garawa	b. Estonian	c. Tripura	d. Cayuvava
$3n+1$	('σσ)('σσ)	('σσ)('σσ)	(('σσ)σ) σ	σ (('σσ)σ)
$3n+2$	(('σσ)σ)('σσ)	(('σσ)σ)('σσ)	(('σσ)σ)('σσ)	σ σ (('σσ)σ)
$3n$	('σσ)('σσ)('σσ)	(('σσ)σ)(('σσ)σ)	(('σσ)σ)(('σσ)σ)	(('σσ)σ)(('σσ)σ)

The success of our analysis relies on the exclusive use of a small set of categorical alignment non-intervention constraints, whose basic format is given in (1):

(1) ALIGN-LEFT/RIGHT (X, *Y, Z): For every prosodic category X, assign a violation mark if some prosodic category Y intervenes between X and the left/right edge of Z, where Z contains X.

In our talk we will show that our set of non-intervention constraints, which only refer to a small set of values for X, Y, Z allowed by *Gen* (viz. the maximal ternary foot, minimal foot, syllable, and prosodic word), are so effective in predicting the full typology, while avoiding pathological patterns, for two reasons: (i) non-intervention constraints are strong *harmonic bounders* and (ii) the interaction between different types of non-intervention constraints is highly *restricted.*

In sum, this paper makes three contributions to the theory of prosodic representations and constraints: (a) it abolishes problematic gradient alignment and lapse licensing constraints (b) it accomplishes full coverage of the attested typology and, along the lines of recent research, (c) it provides further arguments for the existence of weak layered feet.

Stress-dependent harmony and feature split in Felechosa Asturian

Joan Mascaró, CLT-UAB

In this paper I examine harmony sytems that involve a stressed position (Stress-Dependent Harmony, which includes, but does not reduce to metaphony). I assume that they involve prosodic categories (PhWd, and crucially, contra Walker 2011, the foot), and that the basic typology distinguishes three cases, purely phonological harmony (A), featural affix harmony (B), and a third type in which the affix contains both segmental material and a floating feature, or a set of floating features (C):

(1)	A	Phonological harmony:	$[[_{\text{Stem}}\,X]$ (or $[[_{\text{Stem}}\,X]^\frown[_{\text{Affix}}\,Y]]$)
	B	Featural afix:	$[[_{\text{Stem}}\,X],[_{\text{Affix}}\,[F]]$
	C	Mixed affix:	$[[_{\text{Stem}}\,X]^\frown[_{\text{Affix}}Y, [F]]$

A stress-dependent harmonic system with regressive harmony involves, for A, a trigger in X (or in Y) that triggers harmony to its left ('$^\frown$' is the concatenation operator, ',' separates unordered elements). In B the trigger is in the suffix, which consists solely of a floating feature, or set of features, which appear unordered with respect to the stem. In C the suffix is an ordered set consisting of segmental material and a floating feature or set of features.

Systems belonging to A are found in Granada Spanish and Québec French (2), Poliquin 2006, where a final lax vowel triggers regressive laxing; notice that there is spreading both from a suffix and within a morpheme. Systems of type B are illustrated in (3) with Lugo (Romance, Italy, Maiden 1991).

(2)	midzi	'noon'	fɪlɪp	'Phillip'
	puʁ-i	'rotten'	pʊʁ-ɪt	'rotten-fem'

(3)	spós	spús	'spouse-m.sg/m.pl'
	nér	nír	'black-m.sg/m.pl'

In this paper I examine a case of the more interesting type C. In Felechosa (Romance, Asturies, Spain; Rodríguez Castellano 1952, Arias 1992, Nuchi 2009) there is raising of /a/, /e/, /o/ by a final /u/ as in other Central Asturian varieties, but a phonetic change has turned most final [u] to [o]. Compare the results in neighboring Lena and Felechosa:

(4)	*Lena*			*Felechosa*			
	/bwén-u/	→	[bwín-u]	/bwén-o/	→	[bwín-o]	'good-m.sg'
	/bwén-o/	→	[bwén-o]	/bwén-o/	→	[bwén-o]	'good-m.mass'
	/tónt-u/	→	[túnt-u]	/tónt-o/	→	[túnt-o]	'silly-m.sg'
	/tónt-o/	→	[tónt-o]	/tónt-o/	→	[tónt-o]	'silly-m.mass'

Felechosa harmony can be analyzed as a masc.sg. affix that has the segmental properties of /o/ plus [+hi], [–lo] autosegments that will link to the stressed vowel. The problem arises with raising of the low vowel, because in this case in Felechosa there is raising but the masc.sg. marker is not [o], but [u]. Now Lena and Felechosa give the same result:

(5)	*Lena*			*Felechosa*			
	/gwáp-u/	→	[gwép-u]	/gwáp-o/	→	[gwép-u]	'pretty-m.sg'
	/gwáp-o/	→	[gwáp-o]	/gwáp-o/	→	[gwáp-o]	pretty-m.mass'

I will argue that this supports the analysis of the exponence of this morpheme as an unordered pair {[V,+bk, –hi], [+hi,–lo]} where the first element is linked to the skeleton and hence ordered with respect to the stem, wheras the second is floating. In (4) floating [+hi,–lo] link to the mid stressed vowel and cause raising. In (5) faithfulness constraints applying to the low vowel prevent linking of [+hi] to /a/ that would cause raising up to high [i], but [–lo] causes raising to /e/. Since [+hi] has not attached to /a/, constraints requiring floating elements to be realized cause [+hi] to link to the vowel of the morpheme with which it is affiliated, and determines the realization of the masc.sg. morph as [u].

Harmony of Epenthetic Vowels in Betsimisaraka Malagasy

Tim O'Neill University of Delaware *tim@udel.edu*

Betsimisaraka Malagasy, an almost completely undescribed language with a million speakers in Eastern Madagascar, is closely related to the country's national language Official Malagasy (OM), but has a distinct phonology. Fieldwork resulting in these findings took place in the Betsimisaraka town of Vavatenina in 2011 and 2012. Betsimisaraka phonology was found to include three vowel harmony processes not found in OM, the most robust of which is an optional correspondence between the vowel epenthesized to coda-bearing roots and the preceding vowel.

Coda-eliminating vowel-epenthesis is a standard proposal for OM (Dziwirek 1989, Albro 2005, *inter alia*.). This analysis is inspired by the stress contrast seen, for example, between ['tanana] ("hand") and [ta'nana] ("town"). Since OM typically exhibits penultimate stress, antepenultimate stress assignment is explained in terms of URs; here, /tanan/ and /tanana/, respectively. In an ordered-rule analysis, penultimate stress is assigned first, followed by [a]-epenthesis to /tanan/ to remove the violation of a prohibition against codas.

Antepenultimately stressed words in Betsimisaraka can also be analyzed as due to post-stress-assignment vowel epenthesis. And while the epenthetic vowel can optionally be pronounced [a], as in OM, Betsimisaraka also exhibits a harmonic epenthetic vowel. In this system, the final vowel of antepenultimately stressed words matches the quality of the previous, penultimate vowel. While Betsimisaraka has phonemic /e/ and—unlike OM—/o/, these do not surface faithfully in unstressed syllables. Since this harmony process only involves the final two syllables in antepenultimately stressed words, the harmony process only affects [a], [u], and [i]

gloss	**proposed UR**	**SR**	**ungrammatical SR(s)**
"many"	/betsak/	['bets**a**k**a**]	*['betsaku], *['betsaki]
"four"	/efatr/	['ef**aʧa**]	*['efaʧu], *['efaʧi]
"rain" (V)	/maŋoraŋ/	[ma'ŋor**a**(ŋ**a**)]	*[ma'ŋoraŋu], *[ma'ŋoraŋi]
"sand" (N)	/fasik	['fas**i**k**a**], ['fas**i**k**i**]	*['fasiku]
"skin" (N)	/huditr/	['hud**iʧa**], ['hud**iʧi**]	*['huditʃu]
"salty"	/masiŋ/	['mas**i**(n**a**)], ['mas**i**(ŋ**i**)]	*['masiŋu], *[masinu]
"dust" (N)	/vuvuk/	['vuv**u**k**a**], ['vuv**u**k**u**]	*['vuvuki]
"leg"/"foot"	/tungutr/	['tung**uʧa**], ['tung**uʧu**]	*['tunguʧi]
"person"	/oluŋ/	['ol**u**(n**a**)], ['ol**u**(ŋ**u**)]	*['oluŋi], *['oluni]

The resulting distribution is systematic: the epenthetic vowel is either [a] or else matches the final vowel of the root. As in OM, possible UR codas are neutralized on the surface to [k], [ʧ], and a nasal stop—often [ŋ] in Betsimisaraka, an unattested segment in OM. As indicated above, in the case of nasal stops, pronunciation of the final syllable is itself optional in Betsimisaraka, although nasalization of the preceding vowel was occasionally detected.

As in ordered-rule analyses proposed for OM, stress assignment precedes epenthesis in Betsimisaraka. Unlike in OM, however, an optional harmony rule follows epenthesis. Betsimisaraka's optional deletion of nasal codas must precede epenthesis, lest it never have the chance to occur. Likewise, optional vowel nasalization must precede nasal coda deletion.

These findings show yet more evidence for the epenthetic vowel argument for antepenultimate stress in Malagasy, important evidence due to competing analyses offered from, among others, Keenan and Polinsky (1998). Crucially, they also represent a vowel harmony process that is unknown in the well described phonology of OM. Together with other unique aspects of Betsimisaraka phonology, including existence of the segments [ŋ] and [o], and the more limited vowel harmony phenomena, harmony of epenthetic vowels helps distinguish Betsimisaraka as a distinct speech variety of Malagasy.

Feature economy and iterated grammar learning

Joe Pater and Robert Staubs, UMass Amherst
{pater, rstaubs}@linguist.umass.edu

Feature economy. The use of consonant stop voicing across places of articulation is 'economical' (Martinet 1968) since languages that use it for one stop tend to use it for others. In UPSID-92 (Maddieson and Precoda 1992), 244 languages have contrasts at both velar and labial place, 153 have contrasts at neither, while only 11 have just the velar contrast and 43 just the labial one. The occurrence of voicing at each place is clearly not independent: Inventories that have [b] tend to also have [g], and vice versa (chi-squared = 257, d.f. = 1, $p < 0.001$). Feature economy is documented for a range of features in Clements (2003) and subsequent work (Clements 2009, Mackie and Mielke, 2011). One of the main challenges of feature economy is to explain how it holds only as a cross-linguistic tendency. In this paper we show that this challenge can be met by combining a theory of grammar with a theory of learning, which together generate probabilistic outcomes that are distributed typologically through interaction between learners, and begin to address further issues.

Grammar and learning model. We use a Maximum Entropy model of probabilistic grammar (Goldwater and Johnson 2003) with weighted constraints preferring each feature (e.g. [voice] assigns a reward to [b] and [g]), and each conjunction of features (e.g. [voice]⋀[dor] rewards [g]). We used only consonantal voicing and place features, thus these conjunctive constraints are equivalent to ones targeting individual segments. We also included constraints that reward the presence of a segment in an individual word (a sort of Realization constraint; Hare and Elman 1995, Aronoff and Xu 2010, and references therein), which essentially serve the function of OT's underlying representations and faithfulness. Our learning model assumes a broadly used gradual learning algorithm applied to phonological learning in Jäger 2007 and Boersma and Pater (to appear), as well as a procedure for assigning meanings to observed surface strings, a variant of Tesar and Smolensky's (2000) Robust Interpretive Parsing. This grammar and learning model displays biases for patterns that are relatively general in scope. Feature economy can be captured as one such instance because of the way that the general single feature constraints are promoted in learning.

Iterated Learning. Learning biases can be transmitted and amplified when learners become teachers (Hare and Elman 1995, review in Wedel 2012). To assess the typological predictions of the above assumptions about grammar and learning, iterated learning simulations were run in which a pair of agents repeatedly "speak" to each other and learn from one another. For this simulation there were 6 words at three places of articulation, with three candidates for each word: ones with voiced, voiceless or aspirated versions of the initial consonants:

Word 1	[bi]/[pi]/[p^hi]	Word 4	[bi]/[pi]/[p^hi]
Word 2	[di]/[ti]/[t^hi]	Word 5	[di]/[ti]/[t^hi]
Word 3	[gi]/[ki]/[k^hi]	Word 6	[gi]/[ki]/[k^hi]

50 runs of the simulation (20,000 trials each) produced 32 runs that had contrasts at each place of articulation, that is, in which the two Words at a place of articulation each had one candidate that got more than 50% of the probability, and the two such candidates were different. Of these 32, 13 (41%) had the same pattern of contrast across places of articulation – e.g. voiced and voiceless, but not aspirated. There is a statistically significant skew towards uniform laryngeal contrast across place: the observed rate (41%) is much higher than that expected by chance (11%) ($p < 0.001$ by a two-sided exact binomial test). Thus, this model of grammar and learning yields economical use of features: if a laryngeal feature is used at one place of articulation, it tends to be used at others. The further challenge we are currently addressing is why not all features tend to be economical across all dimensions (Blevins 2005); we are testing the hypothesis that feature geometric structure may prove key (Hall 2011).

Alveolars, size and lenition

Markus A. Pöchtrager, Boğaziçi University, markus.pochtrager@boun.edu.tr

This paper (i) presents a new analysis of English *d/t*-lenition, (ii) argues for a particular analysis of the internal structure of alveolars and (iii) hints at a general theory of lenition.

Problem. Within Government Phonology (GP; Kaye, Lowenstamm & Vergnaud 1985, 1990), Harris & Kaye (1990) argued that feet (as in *wáter*) are governing domains, with the stressed nucleus governing the unstressed one. A foot-internal intervocalic consonant is "in the way" and thus prone to reduction. Harris (1997), building on this, argued that foot-internal consonants are weak because they are far down on the licensing scale: They are licensed by unstressed nuclei which are in turn licensed by stressed nuclei. Stops are the most complex objects (highest number of elements), hence the first to go. How *d/t* is reduced will depend on the variety, e.g. by tapping (*wá*[ɾ]*er*) or glottaling (*wá*[ʔ]*er*). Both phenomena can be expressed as the loss of (different) elements. While both analyses explain why foot-initial alveolars resist reduction (e.g. *retáin*) and why only stops are affected (high complexity), they fail to address why only *alveolar* stops are targeted. In the element calculus of the time, alveolars and, say, labials were equally complex: The elements common to *d/t* were **R**, **ʔ**; those common to *b/p* **U**, **ʔ**. Yet, labials do not lenite (*pépper* does not go to **pé*[w]*er*).

Later on the coronal element **R** was replaced by **A** (e.g. Kaye 2000), i.e. the same element characterising non-high vowels. This allowed for a non-arbitrary analysis of English intrusive *r* (which requires a non-high vowel before itself), cf. Broadbent (1991, 1999), but labials and alveolars were still equally complex. With the special status of alveolars unsolved, Harris & Kaye's/Harris's analyses failed to reach explanatory adequacy, remaining (partially) arbitrary.

Proposal. I argue that the solution to *d/t*-lenition in English comes from one particular recent development of the theory, viz. GP 2.0 (Pöchtrager 2006, Kaye & Pöchtrager 2009). In GP 2.0, **A** is *replaced by structure*, based on data like these: In English, long vowels before clusters only occur if both members of the cluster are alveolar: *haunt* vs. **haump*, **haunk*. That is, longer structures are made possible by **A**. Examples like these and many similar ones are also found in German, Finnish, Hungarian etc. (Pöchtrager 2012). Since **A** consistently interacts with structure, it must be structural itself. Objects that contained old **A** are now structurally bigger than those without: They contain an A(djunction)-structure. Thus, alveolars are bigger than velars or labials, giving us a handle on English: If *d/t* are the biggest objects, it is unsurprising that they are the first ones to be targeted by lenition.

This also links nicely to vowel reduction (typically of non-high vowels) in unstressed position as e.g. in Portuguese or Catalan (Harris 1997): Unstressed *o/e* is reduced to *u/i*. Again, this is expressible as the loss of the A-structure in the weak part of the foot. Slightly different reduction patters are investigated in Pöchtrager & Kaye (2011): In Italian, open (but not closed) mid vowels are barred from unstressed position. Open mid vowels are argued to be structurally bigger than closed ones on cross-linguistic grounds, and therefore reduction targets. The upshot being: the larger the object, the more likely that it will undergo reduction.

Further issues. 1. The claim that (old) **A** (now: extra structure) underlies alveolars has been criticised, cf. recently Backley (2011) or Nasukawa (2011). Note however that the above link between lenition of alveolar stops and reduction of non-high vowels is only expressible if both form a natural class. (As achieved by both old **A** and the new A-structure.) **2.** This proposal does not claim that only objects with an A-structure undergo lenition. Danish (Harris 1999) shows foot-internal lenition of stops irrespective of place. However, Danish stops are still the biggest objects of the system, suggesting that Danish is simply less "tolerant" about its weak positions. **3.** My proposal also raises the more general question whether *all* lenitions are about structural size. In GP 2.0, **A** is replaced by structure, but so are the old elements **ʔ** (stop) and **H** (voicelessness). Certainly stopness is a lenition target (Spanish, Catalan, Danish) and so is voicelessness (Danish). Thus, the proposal seems worth following up.

More about the underlying representation of words starting in *VsC-* in Catalan

Clàudia Pons-Moll & Maria-Rosa Lloret (UB)

1. Word-initial V epenthesis in Catalan. In Catalan, V epenthesis has often been invoked to explain the presence of a V in those situations where its absence would entail the occurrence of a structure defying some kind of syllabic constraint. In few of these cases, though, the postulation of epenthesis is fully legitimate by truly productive morphophonological alternations, so that other interpretations of the V are available. Epenthesis has been adduced in words like *e̲scriure* 'to write', *e̲sperar* 'to wait', *e̲structura* 'structure', *e̲sport* 'sport' and *e̲stona* 'while' (with initial [ə̲]), as a strategy to avoid word-initial *sC-* clusters. But the epenthetic nature of the V is only justified in words like *escriure* or *esperar*, by alternating prefixed forms without the V like *in*[∅]*scriure* 'to register', *pro*[∅]*sperar* 'to prosper', which in fact are dubiously productive, as recent prefixed forms, with the V [ə] preceding the stem, show (*ree̲scriure* 'to rewrite'; *dese̲sperar* 'to despair'). Words like *e̲structura* or *e̲stona*, or loanwords like *e̲sport*, lack such alternations, and in fact the V systematically appears in the resultant prefixed forms (cf. *supere̲structura* 'superstructure', *Intere̲sport* 'commercial name'). **2. Goal.** On the basis of the casuistry related to the phenomenon of underapplication of V reduction in Majorcan Catalan (MC), however, we provide independent and significant empirical arguments for an UR of the words starting in *VsC-* without the initial V. **3. Empirical focus and analytical proposal.** In MC, the process of V reduction of the mid front V to schwa in unstressed position (*carr*[é]*r* 'street' ~ *carr*[ə]*r*[ó] 'street *dim.*'; *cont*[é]*st* '(I) answer' ~ *cont*[ə]*st*[á]*m* '(we) answer') underapplies *a*) in productive derived forms with an unstressed V located in the initial syllable of the stem which alternates with a stressed mid front V in the stem of the primitive (*f*[é]*sta* 'party' ~ *f*[e]*st*[á]*ssa* 'party *augm.*'); *b*) in verbal forms with an unstressed V located in the left syllable of the stem which alternates with a stressed close mid front V in another verbal form of the same inflectional paradigm (*p*[é]*ga* '(s/he) hits' ~ *p*[e]*g*[á]*m* '(we) hit'); *c*) in learned words and loanwords with an unstressed *e* located in the left syllable of the stem and generally preceded by a labial consonant (*f*[e]*titx*[í]*sme* 'fetishism'; *v*[e]*d*[é]*t* 'vedet'). These facts are accounted for in Pons (2012, in press) through a set of O-O positional faithfulness constraints relativized according to the position of the V within the stem (cases *a*, *b*), and by a contextual markedness constraint against a schwa in stem-initial position (cases *c*). Interestingly enough, the initial V in word-initial *VsC-* clusters behaves as «invisible» to these O-O positional faithfulness ([ə]*st*[e]*v*[ə́]*t* 'Stephen *dim.*', cf. [ə]*st*[é]*ve* 'Stephen'; [ə]*sp*[e]*r*[á]*u* '(you) wait', cf. [ə]*sp*[é]*ra* '(s/he) waits'), and it is unaffected by the contextual markedness constraint against a schwa in the initial syllable of the stem ([ə]*sp*[e]*cial* 'especial'). And this can be taken as positive evidence that the initial V, realized as a schwa, is actually an epenthetic V. If this were not the case, the second V would not be affected by these constraints, because it would occupy a position other than the initial within the stem. Note, in this respect, that words with the same consonantal structure but with other initial V show regular V reduction to schwa ([u]*st*[ə]*sseta* 'hostess', [u]*st*[ə]*ntar* 'flaunt', etc.). **4. The theories about the determination and acquisition of the UR in the light of our data**. These data is also relevant in order to test the different theories about the determination and acquisition of the UR in cases of lack of morphophonological alternations. Our data does not allow both a ROB approach and a LO approach (Prince & Smolensky 1993/2004), in that if we depart from an underlying representation with the schwa (/əsC/) we obtain inexistent forms with V reduction to schwa of the second V. Indeed, the O-O faithfulness constraints relativized according to the position of the V within the stem or the contextual markedness constraint against a schwa in the initial syllable of the stem would be innocuous (they would not have effects) for the words starting in *VsC-*, in that the V would not be placed in the initial syllable of the stem. V reduction would then apply erroneously in these cases: **Est*[ə]*vet*, **esp*[ə]*ram* and **esp*[ə]*cial*. Only a "free-ride" version of ROB (McCarthy 2005), which predicts a single underlying representation without the V (/sC/), can handle the data. Given the lack of real morphophonological alternations in the cases dealt with in this paper, moreover, we argue for a "free-ride" version of ROB in which morphophonological alternations are not strictly necessary in order to project unfaithful mappings of the type /∅/ → [ə], but just the predictable

Bulgarian Palatalized Consonants: A Phonetics/Phonology Mismatch

Sonia Pritchard, University of Ottawa, sprit001@uottawa.ca
Jeff Mielke, University of Ottawa, jmielke@uottawa.ca

Phonetic and phonological data often converge on similar analyses, because so much of phonology is phonetically motivated. We show that Bulgarian consonants pattern **phonologically** as **consonant+glide clusters**, even as their **phonetic realization** bears much closer resemblance to **palatalized consonants**. This analysis supports the view that while phonetic and phonological representations are closely related, the relationship is not deterministic. On the basis of distributional evidence and 'j-stems' from the traditional 'multi-stem' classification system, we show that Bulgarian palatalized consonants [C^j] pattern as consonant-glide sequences, much like syllable-initial /Cj/ sequences in English. This is surprising in light of phonetic evidence that Bulgarian palatalized consonants are phonetically much more similar to Russian palatalized consonants than to British English consonant-glide sequence (Pritchard 2012).

We explore this phonetics/phonology mismatch by appealing to principles of segmental organization within the syllable, the Sonority Sequencing Principle and the Minimal Distance Sonority Principle (Steriade, 1982; Selkirk, 1984; Clements, 1990), to show that the underlying palatal glide is parsed into the nucleus of the syllable. The limited distribution of palatalized consonants in Bulgarian has prompted some scholars to question their existence in the standard variety (Horálek, 1950; Choi, 1998; Ignateva-Tsoneva, 2008). Following Horálek, they hypothesize that the secondary palatal gesture [^{j}] had decomposed into the palatal glide [j]. Thus, [t^jul] (silk net) would be articulated as [tjul].

The hypothesis that *phonetic* depalatalization has occurred in Bulgarian was rejected by Pritchard (2012). A cross-language acoustic study showed that [C^j] were phonetically present in Bulgarian and that their acoustic attributes matched the [C^j] of Standard Russian, despite distributional differences in these languages. Russian palatalized consonants appear in all environments where plain consonants can be found: next to all vowels of the language ([i e a u o]), in syllable onsets and codas, in consonantal clusters, syllable-initial (C^jC, CC^j) or syllable-medial ($C^j.C$, $C.C^j$, $C^j.C^j$). Bulgarian palatalized consonants appear in very restricted environments: in syllable onsets, before the vowels [a u ɔ].

The phonetic similarities between Bulgarian and Russian palatalized consonants must be independent of the phonological representations of these consonants. Even within the same language, segments which share similar phonetic features may have different phonological behaviours. Davis and Hammond (1995) have shown that in American English the labiovelar glide /w/ syllabifies with the onset consonants while the palatal glide /j/ is part of the vowel /u/ nucleus. As in American and RP English, Bulgarian palatalized consonants [C^j] appear only in syllable onsets. Furthermore, the 'multi-stem' classification system of Bulgarian verb types (Stojanov, 1964) has difficulty proposing a stem type for verbs like [sɛ.**d**^{j}a] (sit, sing., 1st p., present) and **[**sɛ.**d**^{j}ax**]** (sit, sing., 1st p., aorist**)**. The problem is that in the onset position of the second syllable we can have a variety of palatalized consonants on the surface. On the assumption that palatalized consonants are analysed as /Cj/ sequences, these verbs can be classified as having /j/-stems, just as [se.**j**a] (sow, sing., 1st p., present) and [s**j**ax] (sow, sing., 1st p., aorist).

We further argue that the glide in /CjV/ sequences is parsed in the nucleus of the syllable. It has been proposed that segmental relations within the syllable are based on the Sonority Sequencing Principle (SSP) (Steriade, 1982; Selkrik, 1984). Following Clements (1990), we assume that sonority constraints apply at the level of phonology, specifically, at the level of initial syllabification. Bulgarian avoids two sonorants in the onset of syllables as confirmed by the prohibition of the following clusters [*nl, *nm, *rm, *rn, *rl, *lr, *ln, *lm]. In line with Davis and Hammond (1995), we take this as evidence that in Bulgarian the palatal glide in a /CjV/ sequence will be parsed in the nucleus of the syllable, together with the vowel.

The role of [spread glottis] in Grimm's Law

Catherine Ringen
University of Iowa
catherine-ringen@uiowa.edu

Pétur Helgason
Uppsala University
petur.helgason@lingfil.uu.se

Honeybone (2005), Iverson & Salmons (1995) and others have argued that the feature [spread glottis] has played a role in the history of English and other Germanic languages. Following Kim (1970:114), I & S suggest that in /sp/, /st/, and /sk/ clusters in English, there is a single glottal gesture (represented with a single [sg] feature shared by two consonants) with peak glottal opening occurring during the articulation of the fricative, so that by the time the stop is released, the glottis is narrow enough for the voicing to begin immediately, resulting in an unaspirated stop. This contrasts with stops not in clusters (represented by a singleton [sg] feature) where the peak glottal opening is later than it is in fricatives (Kingston 1990:427) so that when the stop is released, the glottis is still spread widely, resulting in aspiration. I & S suggest that the assumption of shared [sg] features in clusters provides an explanation for certain exceptions to Grimm's Law. One part of Grimm's Law relates Indo-European voiceless stops to voiceless fricatives whereby /p/, /t/, /k/ in IE become [f], [θ], [x] in Germanic: IE *pelu > Go *filu* 'very, much'; IE *tak- > Go *þahan* 'to be silent'; IE *kap- > Go *hafjan* 'to lift'. However, voiceless stops after /s/ failed to undergo Grimm's Law: IE *(s)pyaw > Go; *speiwan* '(to) spit'. Given the widely held assumption that the stops that yielded voiceless fricatives by Grimm's Law were aspirated, the failure of Grimm's Law to apply to stops after /s/ can be explained: the voiceless stops were not aspirated so they did not become fricatives. But I & S note that there is another set of exceptions to Grimm's Law that is not so easily explained by assuming that Grimm's Law only applied to aspirated stops. In stop-stop clusters, only the first stop undergoes Grimm's Law: IE *skap-t- > OE *sceaft* 'shaft, pole'.

I & S claim that the aspiration approach implies a very implausible position: Germanic forms like Go *ahtau* [xt] 'eight' arose from forms such as *o[k^{h}t]o (Garrett & Hale 1993), with aspiration on only the first stop. Instead, they suggest that stops became fricatives by Grimm's Law only when the stop in early Germanic was articulated with a spread glottis, not necessarily when it was aspirated. They suggest that stop clusters in early Germanic shared a single glottal gesture, with peak glottal spreading occurring at the end of the first stop so that when the second stop was released, the glottis was narrow enough for voicing to begin immediately and the second stop was, therefore, unaspirated. They claim, then, that the prerequisite for the shift of voiceless stops to fricatives was a substantially open glottis, present in the articulation of singleton voiceless stops, or in stops which formed the first (but not the second) half of a stop-stop cluster. They suggest that the [sg] specification of the first stop did not result in aspiration (indeed they suggest that it couldn't have). Their proposal is that it was the [sg] articulation *alone*, but with no aspiration, that caused the shift from stop to fricative in stop-stop clusters. This position seems as implausible as that of Garrett & Hale which I & S reject.

We suggest that, indeed, the first stops in stop-stop clusters were aspirated, as they are in several Germanic languages today, but that they were *preaspirated.* We agree with the assumption of a single, shared [sg] feature in stop-stop clusters, with early spreading of the glottis, but we suggest that this results in preaspiration. Preaspiration occurs in Swedish, for example, in voiceless intervocalic stop-stop clusters, in final stop clusters and in final stops, as in *däck* [d̥ɛ$^{(h)}$kː] 'tire', *tappa* [t^{h}a$^{(h)}$pːɐ] 'lose (vb.)' (Helgason 2002, Helgason & Ringen 2008). Thus, since preaspiration is clearly a possible implementation of the feature [sg] (Swedish, Faroese), we have a much more plausible explanation for a set of exceptions to Grimm's Law. Instead of a sound change caused by an inaudible glottal spreading, the change in voiceless stops described in Grimm's Law occurred with aspirated stops, either pre-or postaspirated.

‘Big data’ typology and linguistic phylogenetics: design principles for valid datasets

Erich R. Round, University of Queensland e.round@uq.edu.au

New statistical approaches in linguistics, spurred by advances in biology, may yield new insights into the nature of linguistic typology and prehistory, though at this stage many aspects of the research are contentious and subject to debate (Ringe et al. 2002, Dunn et al. 2005, Nakhleh et al. 2005, Donohue et al. 2007, 2008, Dunn et al. 2008, Reesink et al. 2009, Heggarty et al. 2010, Donohue et al. 2011, Donohue 2012, Donohue et al. 2013, Greenhill & Gray 2013). While disagreements have focused on the ability of models to discern vertical transmission versus horizontal (i.e., language contact), and on the merits of various computational methods, little discussion has focused on the design of linguistic datasets themselves. Even where its design is discussed (e.g. Donohue et al. 2007, Holman et al. 2007), phonological data is highly rudimentary. I argue that this is problematic for the methods being used, and explain why. Three principles are then proposed for valid phonological data design for 'big data' computational analyses.

Computational statistical methods are powerful, but results are meaningful only if the input data meet stringent preconditions. Often, input variables must be independent. In linguistics however, a long-standing drive for elegance has led us to cultivate analyses whose individual parts are highly interdependent. In the absence of careful scrutiny, these dependencies will carry over into typological datasets, rendering their analysis by most computational methods invalid or degraded from the outset. I illustrate how these issues emerge in a dataset of >100 typological survey-questions (Dunn et al. 2005, 2008, Reesink et al. 2009), with emphasis on its phonological component. Three methodological principles are proposed for data design:

1. **Use micro answers rather than macro**. Answers to many ‘macro’ questions in linguistics, e.g. “are there prenasalised stops?” are arrived at by weighing up answers to multiple, antecedent ‘micro’ questions, e.g. “does [NC] appear word initially?”, “does /^{N}C/ contrast with /N+C/?”, among others. Confusingly, analyses of two languages may answer macro questions identically while having none of their micro answers in common. Micro answers are more informative.

2. **Identify and minimize dependencies**. In addition to questions whose definitions contain overt logical dependencies, there can also arise ‘covert’ dependencies in datasets, and their identification may require considerable effort. Macro answers for example may share underlying micro answers. E.g. “are there prestopped nasals?” and “are there closed syllables?” are both sensitive to micro questions about intervocalic clusters, giving rise to dependencies.

3. **Track dependencies**. Where dependencies do remain in a dataset, they must be recorded. Doing so enables one to sample *subsets* of the data which are reliably independent.

Until principles such as these are adhered to, the application of advanced statistical methods to typological linguistic datasets will remain mathematically compromised, irrespective of other debates which must also be resolved.

Positional restrictions on prenasalized consonants: a perceptual account

Juliet Stanton, MIT (juliets@mit.edu)

I present results of a cross-linguistic survey documenting positional restrictions on the distribution of prenasalized consonants (NCs). The major finding of this study is that NCs are optimally licensed in contexts where they are perceptually distinct from plain oral (C) and plain nasal (N) consonants. I propose an analysis referencing auditory factors, and show that a perceptual account explains all attested patterns.

One auditory property differentiating NCs from Ns is the presence of a release burst (Burton et al. 1992). In addition, Ns and NCs are most identifiable when Ns are followed by nasal vowels and NCs by oral vowels (Beddor & Onsuwan 2003). Identification of Cs and NCs is reliable given the presence of internal cues alone, but is also affected by the degree of nasalization in a preceding vowel (B&O 2003). A partial list of cues to the C-NC and N-NC contrasts is below.

C-NC	N-NC
• presence vs. absence of nasal formants	• presence vs. absence of release burst
• difference in VC transitions (oral vs. nasal)	• difference in CV transitions (nasal vs. oral)

Adopting the hypothesis that phonemic contrasts are first licensed in contexts where cues to the contrasts are readily available (Steriade 1997), I make several predictions regarding the distribution of NCs. First, if NCs appear initially (#_V), they should appear intervocalically (V_V), as transitional cues to the C-NC contrast are present inter-V but absent initially. Second, if NCs appear finally (V_#), they should appear inter-V, as transitional cues to the N-NC contrast are present inter-V but absent finally. I present a typology of 45 languages with NCs that allow obstruents in all three positions, and show that my predictions are borne out. 39/45 languages allow NCs initially; of those 39, 37 allow NCs medially. Furthermore, while 17/45 languages allow NCs finally and inter-V, no language allows NCs finally only. These mirror-image distributional asymmetries receive identical explanations: N/C-NC are first neutralized when transitional cues are absent. Language-specific phenomena, such as an apocope process in Lolovoli (Hyslop 2001) targeting post-N/C but not post-NC vowels, suggest that the link between perception and contrast is synchronically active.

The importance of transitional cues to N/C-NC is further established through consideration of languages allowing both NCs and a phonemic contrast in vowel nasality (V-Ṽ). I present a typology containing 15 systems of this type culled from a genetically diverse sample of 500+ languages, and discuss similar inventories identified by Maddieson (1984). Based on the cues listed above, I predict that V-Ṽ will be restricted next to C/N/NC: in these contexts, the V-Ṽ contrast may eliminate or reduce cues that N/C-NC rely on. Language-specific contexts of V-Ṽ neutralization verify this prediction. In Acehnese (Durie 1985), V-Ṽ is neutralized post-N and post-NC. In Gbeya (Samarin 1966), V-Ṽ is neutralized pre-C and post-NC. These patterns reflect the importance of transitional cues to the perception of N/C-NC. In addition, I discuss evidence that the distinctiveness requirements of N/C-NC and V-Ṽ conflict. In Lua (Boyeldieu 1985), V-Ṽ is possible post-NC only when vowels are long. Results from perceptual experiments have highlighted the importance of duration to reliable identification of V-Ṽ (Delattre & Monnot 1968, Beddor 1989); I argue that the pattern in Lua arises because long (but not short) Ṽs can accommodate the oral CV transitions that allow the N-NC contrast and remain distinct from Vs.

I propose a Dispersion Theoretic analysis (Flemming 2002), with constraints penalizing perceptually weak contrasts and articulatorily complex sequences, to capture positional restrictions on NCs and interactions between N/C-NC and V-Ṽ. A perceptual account is sufficient to explain all observed typological generalizations and language-specific patterns.

The cycle without containment: Romanian perfects
Donca Steriade, MIT

This paper analyzes an unusual form of asymmetric correspondence, which links the stem of the Romanian tensed perfect (similar to French *passé simple*) to its perfect participle. The pattern is illustrated in abbreviated form below. Only 3rd person forms are shown. Verbs from the *a-*/*i-* conjugations are omitted, but will be consistent with the proposed analysis. The verbs in (1) illustrate all variations in building participles and tensed perfects from remaining conjugations.

1. Perfect forms of three Romanian verbs, and corresponding infinitives

infinitive	*ved–eá* 'to see'		*árd–e* 'to burn'		*fiérb–e* 'to boil'	
perf. part.	[*vʌz–ú–t*] 'seen'		[*ár–s*] 'burnt'		[*fiér–t*] 'boiled'	
perfect	[*vʌz–ú*] 'saw-3sg'	[*vʌz–ú*]*–rʌ* 'saw-3pl.'	[*ár–s*]*–e* 'burnt-3sg'	[*ár–s*]*–e–rʌ* 'burnt-3pl'	[*fiér–s*]*–e* 'boiled-3sg'	[*fiér–s*]*–e–rʌ* 'boiled-3pl'

The stem allomorph of tensed perfects is identical to the one found in the participle, with one difference: the perfect participle suffix *–t* is systematically suppressed in tensed verbs. This is seen in [*vʌz–ú*]*–rʌ* (*[*vʌz–ú–t*]*–rʌ*) and [*fiér–s*]*–e* (*[*fiér–t*]*–e*): post-vocalic *–t* in the participle is eliminated completely, post-consonantal *–t* is replaced by *–s*. In all other respects, the verbal and participial perfect stems are identical: the identities in (1) hold of all Romanian verbs.

When the participle is sigmatic (e.g. *ár–s*) it is used unchanged as the stem of the tensed perfect. This suggests that *–s* is a general exponent of perfect aspect, and is thus free to appear in both participles and in tensed forms. By contrast, *–t* is, as in Latin, the exponent of morpho-syntactic features specific to the participle and is thus blocked from the stem of tensed verbs. The partial identity between the stems of the participle and of the verbal perfect follows from the interaction between violable exponence conditions (Wolf 2008) with a constraint requiring the stems of perfect forms (tensed or participial) to stand in correspondence.

I show that the correspondence relation between the perfect stems is asymmetrical, as in standard Base-Derivative cases (Benua 1998): here the base is the participle, the derivative is the tensed perfect. Stress patterns demonstrate this asymmetry: in participles, stress is predictable from general principles that hold for all morphologically simple forms, in all lexical categories (Chitoran 2002, Steriade 1985): stress falls on final heavy (VC(C)) rimes, otherwise on penults. The markedness constraints characterizing the general pattern (avoidance of final stress on light syllables, and right-lapse avoidance) are violated in the tensed forms: e.g. *vʌz–ú* stresses a light final; *fiér–se–rʌ* has antepenult stress. These markedness violations suggest cyclic inheritance and follow from an analysis that computes stress in the participle (e.g. *vʌz–ú-t, fiért)* and then transmits stress unchanged to the tensed forms, via a ranking BD IDENTSTRESS >> MARKEDNESS.

This looks like cyclic stress assignment, but it is not normal cyclicity: the base (the perfect participle) is not always contained in the derivative (the tensed perfect), because the participial suffix *–t* cannot appear inside a tensed form. Yet the same suffix *–t* that's prohibited from the tensed stem is responsible for that stem's stress: final stress in participial *vʌz–ú–t* is due to the final consonant; this consonant disappears from the verb, e.g. in *vʌz–ú,* but the stress remains. In this case, the similarity between base and derivative results from a derivation in which the base is blocked from appearing in its entirety in the derivative. A modification of the phonological cycle is proposed based on this and similar Latin data. The modification accounts for the possibility that bases are not contained in their derivatives, and it explains why the participle is the base in the Romanian case, but not in closely comparable ones, like Latin.

Erring on the side of phonology

Patrycja Strycharczuk[a] *and Koen Sebregts*[b]
pstrycharczuk@gmail.com, k.sebregts@uu.nl
[a]*Labex-EFL, Lab. de phonétique et phonologie, UMR 7018 CNRS/Univ. Sorbonne-Nouvelle Paris 3*
[b]*Utrecht University*

Allophony has previously been singled out as a particularly complex issue for theories of the phonology-phonetics interface, particularly the discussion of the relative role of contrast and discrete phonetic variation in informing abstract phonological representations (Ladd, 2006; Currie-Hall, 2009, *inter alia*). Some cases of allophony are commonly assumed to form a part of abstract representation (e.g. Giegerich (1992) on English /t/-allophony), whereas other aspects of systematic phonetic variation may generally not be considered as phonological (e.g. /k/+vowel coarticulation in English). While phonologists seem to share an intuition that not all cases of allophony are equal, rarely do they provide explicit diagnostics for mapping allophonic variation onto phonological categories. We consider this issue in the context of Standard Dutch /r/-allophony.

An increasingly frequent pattern in Standard Dutch is that of syllable-conditioned /r/-allophony with a bunched or retroflex approximant in the coda, and a uvular or alveolar consonant in the onset. Articulatory data from Scobbie & Sebregts (2010) show that the variation is largely categorical in nature. This could potentially support treating the coda and onset /r/-variants as phonologically distinct. Such an analysis, however, is complicated by the new data presented in the current study, which focuses on /r/ in sandhi contexts, pointing to a strong identity between coda and onset /r/.

Our findings are based on a combined articulatory and acoustic analysis of data from four speakers of Standard Dutch (1 male, 3 females, aged 20-22), using Ultrasound Tongue Imaging. The speakers read three repetitions of sentences containing /r/ tokens embedded in systematically varied phonological environments, including: 1) word-initial onset, e.g. *pa reizen*; 2) word-medial onset, e.g. *Parijzenaar*; 3) word-final coda, e.g. *paar meisjes*; 4) word-final prevocalic coda, e.g. *paar eisen*; 5) fake geminate context, e.g. *paar reizen*.

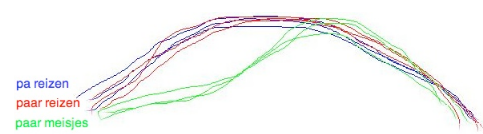


Figure 1 Onset, coda and fake geminate /r/. Tongue tip is on the right.

The results confirm that speakers have two categorically distinct /r/-variants in onsets and codas, with relatively little variation across different sentence contexts. These are exemplified in Figure 1 for speaker LH, who maintained a categorical distinction between bunched /r/ in coda (*paar meisjes*), and uvular /r/ in onsets (*pa reizen*). Crucially, the fake geminate context patterned with the onset environments in terms of tongue shape, with no trace of bunching in *paar reizen*, in contrast to the other coda contexts. No significant difference in /r/-duration was found between word-initial onsets and the fake geminate contexts.

We take these findings to support the generalisation that an onset /r/ exerts a strong coarticulatory influence on the preceding coda /r/, phonetically manifested as extreme coda reduction/deletion. Similar phonetic behaviour is not found preceding other consonantal onsets. Instead, it appears unique to the /r#r/ context, which we interpret as conditioned by the shared identity among different /r/-allophones. Importantly, this identity must be understood as phonological and abstract, given that the surface phonetics of coda and onset /r/s are so different. This, in turn, leads to the question of how to reconcile this shared phonological identity with evidence for categorical distinctness in Dutch /r/-allophony in representational terms. We propose an analysis following Ladd (2006), who argues for multi-level phonological categories. We link this representation to theories of bottom-up phonological category formation with additional lexical supervision (Boersma, 2012), where phonological categories may emerge from different sources (from phonetic distinctness, through sociolinguistic awareness, to lexical contrast), and where relative category strength may be a reflection of whether or not different sources of categoryhood converge.

Open Syllable Lengthening and iambic-trochaic rhythm in Middle Dutch

Johanneke Sytsema & Aditi Lahiri
University of Oxford
johanneke.sytsema@ling-phil.ox.ac.uk, aditi.lahiri@ling-phil.ox.ac.uk

OSL or Open Syllable Lengthening has been a controversial topic in Germanic phonology. Although the West Germanic (WGmc) languages underwent OSL during the medieval period, it is still not entirely clear when the process began in individual languages. When examining metrical feet in verse, it becomes crucial to determine which syllables are heavy or light and hence, the presence or absence of OSL becomes particularly relevant. For example, a disyllabic CVCV(C) word is often accepted as a single heavy position in Germanic verse due to resolution equating LX and H. If a light syllable followed, then it could easily be incorporated into one foot as "Gode al" in (1b). However, a sequence like CVCCV(C) would be treated as HX which would not attract a following syllable into a single metrical position (cf. 2b - "wanneer-dat" is impossible). If however, the first syllable has a long vowel due to OSL, the initial syllable would be bimoraic and should also be treated as an HX sequence, and therefore unable to attract another light syllable into one metrical position (examples from Lutgart).

(1) a) Dire'eeren 'Gode al 'sonder 'wanc	b) Dir~~e~~ ('eeren) ('God~~e~~ al) ('sonder) ('wanc)
(2) a) So 'wanneer 'dat si 'iet ver'stuende	b) So ('wanneer) ('dat si) ('iet ver)('stuende)
	*So ('wanneer dat) si 'iet ver'stuende

While examining two Middle Dutch texts (13th and 14th century) written in verse we encounter conflicting evidence for vowel length. The older text Lutgart has been claimed to be written in iambic tetrameter (Zonneveld 1992), while a poem written a century later, namely, Saladijn has essentially been unstudied. Earlier work based on rhythm and footing (Fikkert 2000) suggests that OSL had not occurred in Lutgart. Although orthography has been considered to be unhelpful, a closer look at the texts combining orthographic and metrical evidence, suggests that although Lutgart has probably escaped OSL Saladijn may not have done so. The evidence is as follows:

i) Original WGmc long vowels, which remained long in OHG and OE, were almost always written with two letters in Lutgart; e.g. eere < PGm *aizō, cleeder < PGm *klaiþa, loene < PGm *launa-. One could expect that if the vowels were long in open syllables, double letters would have been used, but this is not found with original short vowels.
ii) Saladijn presents a different picture; original short vowels are often written with two letters in closed syllables while rarely in open syllables, e.g. coomt/comen < pgm.*kweman. Furthermore, unlike Lutgart, original long vowels are also not written with two letters in open syllables, for instance, staen/te volstane < PGm *stē-. Thus Saladijn followed the modern Dutch orthographic style where length is indicated by single letters in open syllables and two letters in closed syllables.
iii) Equally important is the evidence from verse. In Saladijn, CVCV(C) and CVCCV(C) sequences are treated alike in verse, suggesting that both are HX sequences, rarely incorporating following light syllables into a single metrical position.
iv) One could argue that if OSL had already occurred, original long and short vowels of the same quality would rhyme. However, this evidence is unlikely in Saladijn because our earlier research shows that vowels of different WGmc origin do not rhyme, suggesting difference in quality.
v) Assuming OSL in Saladijn, but not in Lutgart, clarifies the type of metrical rhythm in these texts. Lutgart is assumed to be the only early text written in iambic verse, while all later verse like Saladijn is said to be trochaic. But this assumption leads to very odd metrical parsing. If we assume that OSL has already taken place, and parse feet accordingly, we find that Saladijn is also an iambic system.

Thus, a combination of diachronic correspondences and a careful examination of rhythm helps us to understand the synchronic systems of 13th and 14th century Middle Dutch and ascertain when certain prosodic changes like OSL have taken place.

Phantomizing opacity: metaphony and copy-vowel epenthesis in Sardinian

Francesc Torres-Tamarit[1], Kathrin Linke[1,2], Maria del Mar Vanrell[3]
francescjosep.torres@gmail.com, kathrin.linke@meertens.knaw.nl, maria.vanrell@uam.es
[1]Meertens Institute (The Netherlands); [2]Leiden University (The Netherlands);
[3]Universidad Autónoma de Madrid (Spain)

The general claim of this paper is that monovalent features in parallel OT solve an underapplication pattern of metaphony in Sardinian; indeed, opacity is just a *phantom* if the right representations are assumed and parallel computation is left intact.

Problem & data. At the surface level, all Sardinian varieties present a 7-vowel system ([i,e,ɛ,a,ɔ,o,u]) in stressed position. In unstressed word-final position, Campidanese provides a reduced system of 3 vowels ([i,a,u]), as opposed to Logudorese (& Nuorese), which show a 5-vowel system ([i,ɛ,a,ɔ,u]). The presence of the mid tense vowels [e,o] in stressed position is always the result of metaphony. The mid lax vowels /ɛ,ɔ/ raise to the mid tense vowels [e,o] when followed by the high vowel suffixes [-i,-u] (ˈn**o**.u 'new.M.SG' *vs.* ˈn**ɔ**.a 'new.F.SG'; ni.ˈ**e**ɖ.ɖu 'black.M.SG' *vs.* ni.ˈ**ɛ**ɖ.ɖa 'black.F.SG').

In Campidanese, cases of underapplication of *metaphony* are found (ˈk**ɔ**.ɾu 'heart.M.SG.'; ˈm**ɛ**.ʁi 'honey.M.SG.'), where mid lax vowels fail to raise preceding high vowel suffixes. It is relevant to observe that the corresponding suffixes in Logudorese (& Nuorese) are not high (ˈk**ɔ**.ɾɔ, ˈm**ɛ**.lɛ). The latter varieties do not display vowel reduction.

The second relevant process is *copy-vowel epenthesis* after word-final consonants (*tempus* ˈtɛm.p**u**.z**u** 'time.M.PL'; *letamen* la.ˈða.m**i**.n**i**, 'manure.M.SG.'). Whereas in Nuorese the word-final vowel is fully copied, in Campidanese the copy can be partial in accordance with the reduced vowel system in word-final position (*ses* ˈs**ɛ**.z**i** 'you are' *vs.* Nuorese *ses* ˈs**ɛ**.z**ɛ**). This leads to additional cases of underapplication of metaphony in Campidanese, where word-final high vowels, in these cases epenthetic vowels, do not cause raising of preceding mid lax vowels. This situation is a general problem for parallel OT.

Prerequisites. The analysis relies on monovalent features, which allow for the distinction between two classes of suffixes in Campidanese that differ in their underlying specification for {ATR}, although they surface identically in this variety as [i,u] due to vowel reduction. Underlyingly, metaphonizing suffixes are therefore /{ATR,(HIGH)}/ and non-metaphonizing suffixes, /{(HIGH)}/, with optional {HIGH} due to ROTB. The metaphony targets /ɛ,ɔ/ are unspecified for height.

Analysis. First, in non-low unstressed vowel suffixes in Campidanese, {HIGH} is inserted to comply with vowel reduction due to the ranking *{LOW,ATR}≫*a≫*ɛ,ɔ≫*e,o≫ DEP(HIGH),*i,u. This leads to the above-mentioned neutralization of suffixes on the surface. Second, if {ATR} is present underlyingly, metaphony applies as the result of terminal {ATR}-spreading (REALIZE(ATR) ≫DEPLINK). The last ranking enforces the surface realization of {ATR}. However, in the suffixes lacking underlying {ATR}, {ATR} can neither be deleted, delinked nor inserted due to undominated MAX(ATR), MAXLINK and DEP(ATR). Faithfulness to {ATR} is thus paramount. Therefore, what seems to be a case of underapplication of metaphony in the latter case naturally follows from differing suffix representations. Third, word-final epenthetic high vowels behave as the suffixes lacking {ATR}, i.e. they do not trigger metaphony. They gain their feature specifications by spreading the minimally necessary features from the preceding lexical vowel to comply with vowel reduction (V-place & {HIGH}). In any case, spreading or insertion of {ATR} is not optimal. These operations are harmonically bounded since they gratuitously add violations of DEPLINK and DEP(ATR), respectively.

In constrast, if binary features were assumed, the OT ranking responsible for vowel reduction would force all suffix vowels to be specified for [+ATR], which is the structural environment for metaphony. Because of that, the very same OT grammar could not prevent the overall application of metaphony. This paper pursues the idea that opacity should be tackled by a representational approach rather than a computational one.

An ultrasound investigation of /l/-darkening in varieties of English

Danielle Turton – University of Manchester

The phenomenon of /l/-darkening, whereby /l/ is produced with a delayed tongue-tip gesture, has been a subject of linguistic interest due to its complex phonological and morphosyntactic conditioning. Although syllable-based accounts state that light [l] occurs in onsets (e.g. *light*) and dark [ɫ] in codas (e.g. *dull*), several studies report dark [ɫ] in the onset under certain morphosyntactically determined conditions (see Table 1).

	light	*yellow*	*heal-ing*	*heal it*	*heal*	
RP	[l]	[l]	[l]	[l]	[ɫ]	Cruttenden (2008)
Am. Eng. 1	[l]	[l]	[l]	[ɫ]	[ɫ]	Sproat & Fujimura (1993)
Am. Eng. 2	[l]	[l]	[ɫ]	[ɫ]	[ɫ]	Olive et al. (1993)
Am. Eng. 3	[l]	[ɫ]	[ɫ]	[ɫ]	[ɫ]	Hayes (2000)

Table 1: /l/-darkening in different environments. Adapted from Bermúdez-Otero (2007)

Moreover, for some dialects such as Manchester, /l/ is reported to be dark in all environments (Cruttenden 2008; Kelly & Local 1986). The present paper uses ultrasound to test two claims: firstly, the report that Manchester /l/ is always dark, and secondly, that there is a variety of RP where /l/ is dark only in non-prevocalic position. Bermúdez-Otero (2007, 2011) uses the /l/ allophony patterns above to argue for a modular architecture of grammar and the life cycle of phonological processes. This theory crucially predicts the existence of a dialect where darkening applies only phrase-finally, though this has not been vindicated by instrumental articulatory evidence until now.

Speakers of RP and Mancunian English were recorded producing /l/ in five contexts: word-initial, word-medial before a vowel in the same stem, word-medial before a suffixal vowel, word-final prevocalic, and phrase-final, corresponding to the headings in Table 1. The findings provide the missing empirical evidence needed to support the first stage of the life cycle of phonological processes. The RP speaker illustrated in Figure 1 shows the pattern of /l/-darkening reported by Cruttenden (2008), with [ɫ] only in non-prevocalic position: the backed tongue body, reduced tongue-tip gesture, and retracted tongue root typical of [ɫ] are found in prepausal *heal* only, and not in *heal it*. This demonstrates that there exist varieties of RP that do have a very conservative pattern, with a phrase-level alternation between light [l] prevocalically, and dark [ɫ] phrase-finally.

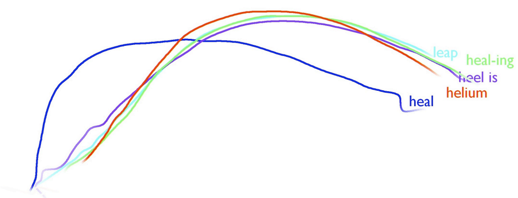


Figure 1: The RP pattern

Figure 2: The Mancunian pattern

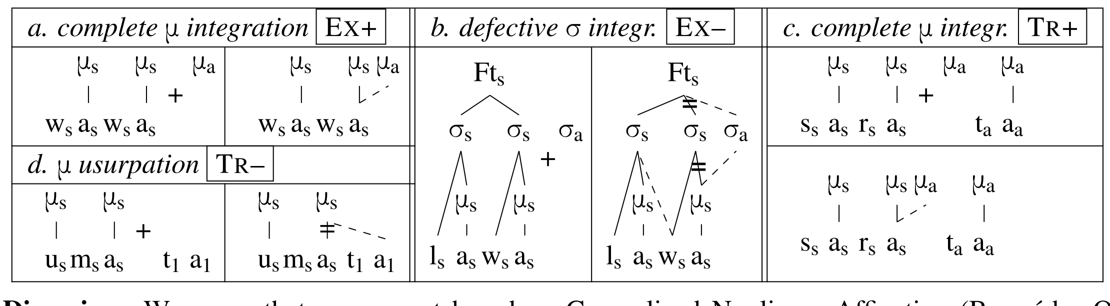
Additionally, there are similarities between RP and Mancunian English, the latter of which is claimed to have no allophonic alternation. However, ultrasound imaging shows that phrase-final /l/ in the Mancunian data is marginally but significantly ($p < 0.05$) backed compared with the other contexts (Figure 2).

Thus, the data from the two dialects confirm the reconstruction of the life cycle of /l/-darkening shown in Table 1, providing hitherto absent instrumental evidence for the most conservative initial stage, whilst raising important questions. Firstly, it is not immediately obvious why darkening has not undergone analogical spreading in RP and Mancunian, as it has in certain American English varieties. Moreover, the Mancunian pattern is clear in articulation, but has so far evaded acoustic detection, prompting questions as to how it is auditorily cued and transmitted. Finally, the fact that the two dialects show a similar distribution of categories, yet differ starkly in their phonetics, raises important questions about the abstract nature of allophonic categories.

A phonological account to Length-Manipulation in the Morphology
The case of Aymara

Eva Zimmermann & Jochen Trommer (University of Leipzig)
{Eva.Zimmermann,jtrommer}@uni-leipzig.de

Main Claim: We argue that the affixation of (defective) phonological material is able to predict all attested patterns of length-manipulating morphological processes (=LMMP). Such an account predicts a directionality preference found in the typology of LMMP and the coexistence of different LMMP in a single language. The latter is exemplified with an analysis for Aymara. **The phenomenon:** In Aymara (Briggs, 1976; Beas, 1999; Beesley, 2000; Hardman, 2001; Kim, 2003), four different LMMP coexist: additive (=lengthening/insertion; '+') and subtractive (=shortening/deletion; '–') patterns that are either exponent of a morpheme (=EX) or are triggered by the presence of another (segmental) morpheme (=TR). Examples are *a.)* /sara/ 'go'→/saraː/ 'I will go' EX+, *b.)* /lawa/ 'wood'→/law/ 'wood (Acc)' EX–, *c.)* /sara/ 'go'+ /–ta/→/saraːta/ 'you will go' TR+, and *d.)* /chinu/ 'to tie'+ /–thapi/→/chinthapi/ 'tie two things together' TR–). These processes are bound to a specific morphological context and cannot be regarded as general phonological rules. **An analysis for Aymara:** Below, the underlying structures we assume for the four relevant morpheme types in Aymara are given. A floating μ (*a.+c.*) is completely integrated into the prosodic structure and induces lengthening. This follows in OT from the constraint *FLOAT (Kirchner, 2007) that demands integration for prosodic nodes. The morpheme-specific V-deletion *d.*, we argue, follows from another possible moraic specification for a morpheme: an underlyingly μ-less V that strives to associate to a μ. Since insertion of a μ is impossible (high-ranked DEP-μ), the V associates to the μ of the preceding V. This leads to the marked situation that one μ is associated to two Vs and the underlying association from the μ to the stem V is marked as uninterpretable, hence invisible, for the phonetic interpretation. Such an 'usurpation' process is straightforwardly predicted under an OT account assuming containment (Prince and Smolensky, 1993/2002). In such a framework, no phonological element or association line can be deleted but can remain uninterpretable for the phonetics. In fact, the fourth length-manipulating process in Aymara constitutes a strong argument for a containment-based account: Aymara regularly stresses the penultimate σ if the final V is short. After morphological V-deletion, however, stress remains on the final σ (e.g. /wira–ma/ LIFE-2P-ACC [wi'ram]). This follows in our analysis from assuming that morphological V-deletion *b.* involves a catalectic σ (Kager, 1999). The deletion-triggering accusative morpheme consists of an empty σ node that must be fully integrated into the prosodic structure of its base. This, however, results in a configuration where a μ is integrated under two σ nodes and one underlying association relations must be marked as invisible to repair this marked structure. If the final μ is not integrated under a phonetically visible σ, the final V hence remains uninterpreted. The foot still dominates two σ nodes phonetically and no shifting of the main stress is expected.



Dicussion: We argue that an account based on Generalized Nonlinear Affixation (Bermúdez-Otero, 2012) can predict all attested patterns of LMMP and also the coexistence of different LMMP in one language. This account derives apparently morpheme-specific operations through a purely phonological account and without direct reference to morphological information (Inkelas, 1990).

Poster papers

Morphology in phonology: Lexical Conservatism in Romance

Eduard Artés
CLT – Universitat Autònoma de Barcelona
eduard.artes@uab.cat

1) Goal. This talk aims to present empirical and theoretical evidence in favor of the idea of epenthesis as a morphological phenomenon. Data from Italian, Spanish, Catalan and Occitan elucidate the trade-off between morphology and phonology in some determined contexts such as gender agreement. Morphology provides phonology with an exponent already present in the paradigm, Lexical Conservatism (Steriade 1994) being the main reason for it. Moreover, the epenthetic processes present in Italian loanword phonology demonstrate that inflectional endings of the nominal system should be treated as class markers (Acquaviva 2009).

2) Spanish epenthesis. Traditionally (see Saltarelli 1970 and Harris 1986), it has been argued that epenthesis applies in word-final position to satisfy syllabic requirements. The question we have to adress is whether final -e is still epenthetic (*carne* 'meat', **carn*) or it has been reinterpreted as a common class marker (Harris 1999, Bonet 2006). This illustrates what has been called morphological epenthesis (Cardinaletti & Repetti 2008), *i.e.*, a direct relation between morphology and the phonological content of epenthesis.

3) Lexical Conservatism in Romance determiners. Morphological epenthesis is also related to the notion of Lexical Conservatism. Catalan, Italian and Occitan present a similar pattern of vowel epenthesis in the masculine determiner. According to Repetti (2012) ‘i’ is the initial and medial epenthetic vowel in Italian. Following her, I assume for Italian (as for Catalan and Occitan) an underlying masculine determiner /l/ (cf. Garrapa 2012):

- Italian:	/l#fratɛl:o/ > [*i*lfratɛ́l:o] (phon. epenthesis)
	/l#amiko/ > [lamí:ko]
	/l#skandalo/ > [l*o*skándalo]
-Catalan:	Central Catalan: /l#maɾ/ > [əlmár] (phon. epenthesis)
	NorthWestern Catalan: /l#aɾbɾe/ > [larβɾe]
	NorthWestern Catalan: /l#paɾe/ > [l*o*páɾe]
-Occitan	/l#gal/ > [l*u*gál]
	/l#amig/ > [lamík]

In front of a C-initial noun, we see a regular pattern of epenthesis in Italian and Catalan (‘i’ and schwa as default epenthetic vowels). However, in certain cases the vowel [o] ([u] in Occitan), usually used as an exponent for masculine, seems to resolve the phonological problem.

4) Epenthesis in loanwords as evidence for class markers. In addition, epenthetic processes in the loanword phonology of Italian seem to converge in the same direction:
-Frankfurt > Francofort[e] / -Stockholm > Stoccolm[a] / -Zurich > Zurig[o]
This paragogic process uses different vowels to solve the phonotactic requirements of Italian. In regular epenthesis, we would expect final –i to appear, but we find three different vowels instead. In an OT framework, a constraint *NULL –“assign one mark for each morpheme with no overt exponence in the output”- (Giavazzi & Katz 2010) decides the selection of an output with an overt class marker as a product of morphological markedness.

5) Conclusion. All in all, the data presented here give support to the idea that morphological epenthesis is a widespread phenomenon in Romance languages, as we can see instances of it in many varieties. In the case of the determiners, it is used for gender specification. In loanwords, it helps to give them the same inflectional character of native words. Furthermore, Lexical Conservatism ‘recycles’ what it is already present in the morphology to avoid new phonological variants.

The interaction of L1 phonotactics and substance during acquisition of morphophonemic alternations with exceptions

Dinah Baer-Henney[1], *Frank Kügler*[1] *& Ruben van de Vijver*[2]

University of Potsdam[1], University of Düsseldorf[2]
{dinah.baer.henney, kuegler}@uni-potsdam.de, Ruben.Vijver@uni-duesseldorf.de

Most morphophonological alternations have exceptions. Alternations present the learner with the difficulty that there is is no one to one mapping of form and meaning (van de Vijver and Baer-Henney, 2011; Kerkhoff, 2007); alternations with exceptions are even harder to acquire. In this paper we have studied the acquisition of alternations in the Artificial Language Paradigm (ALP) and we found that German adult learners use different cues for two types of morphophonemic alternations that are exceptional to different degrees. In our artificial language a plural suffix alternated between -[y] or -[u] depending on the vowel of a CVC stem; a local, tier-adjacent dependency. One alternation was a vowel harmony (VH), where the backness of the stem vowel determined the backness of the suffix. VH is based in substance (Linebaugh, 2007). The distinction between front and back vowels has no consequences for syllable structure in German. In another alternation (AV) the tenseness of the stem vowel determined the backness of the suffix. AV is phonetically arbitrary. However, the distinction of tense and lax vowels plays an important role in German phonotactics (Wiese, 1996). Lax vowels appear only in closed syllables, and tense vowels also appear in open syllables. Exceptional items in our paradigm followed the opposite pattern. The alternation types are summarized in table 1.

Table 1: alternation types

	add allomorph -[y] if	add allomorph -[u] if
VH: vowel harmony	$V_2 \rightarrow V_{2[-\text{back}]}$ / $CV_{1[-\text{back}]}C$ _ #	$V_2 \rightarrow V_{2[+\text{back}]}$ / $CV_{1[+\text{back}]}C$ _ #
VH exceptions	$V_2 \rightarrow V_{2[-\text{back}]}$ / $CV_{1[+\text{back}]}C$ _ #	$V_2 \rightarrow V_{2[+\text{back}]}$ / $CV_{1[-\text{back}]}C$ _ #
AV: arbitrary vowel alternation	$V_2 \rightarrow V_{2[-\text{back}]}$ / $CV_{1[\text{lax}]}C$ _ #	$V_2 \rightarrow V_{2[+\text{back}]}$ / $CV_{1[\text{tense}]}C$ _ #
AV exceptions	$V_2 \rightarrow V_{2[-\text{back}]}$ / $CV_{1[\text{tense}]}C$ _ #	$V_2 \rightarrow V_{2[+\text{back}]}$ / $CV_{1[\text{lax}]}C$ _ #

80 adults were familiarized with artificial input. It always contained a majority and a minority – exceptional – alternation. In different groups, the input contained items that conformed to either 85% or 65% of the target alternation.The remaining plural forms followed the exceptional rule. This resulted in four groups with 20 subjects each: VH-85, VH-65, AV-85 and AV-65. After the training we asked the subjects to form plurals of 96 given new singular forms (Berko, 1958). We measured the extent to which subjects have learned the trained majority alternation. A generalized linear mixed model confirmed that subjects who were trained with the 85% alternations produced more items that were in conformity to the majority input alternation than those that were trained with only 65% alternations. Post-hoc analyses showed that learners generalized the input pattern of the AV-85 condition more often to novel items than leaners in the VH-85 condition. When the input contains more exceptions the learners' generalizations are reversed: In the VH-65 condition learners more often generalized the alternations to novel items than in the AV-65 condition.

We explain our data with the interaction of L1 phonotactics and substance: To summarize, we show that depending on type and regularity of an alternation the learners make use of different cues to support the acquisition of morphophonemic alternations.

Sets of features *vs.* sets of sets of features:
A notational innovation for phonological rules

Alan Bale, Maxime Papillon & Charles Reiss
Concordia University
charles.reiss@concordia.ca

Consider a rule like this, in traditional format:

(1) $[-\text{HIGH},\ -\text{LOW}] \rightarrow [+\text{HIGH}]$ / ___$[+\text{NASAL}]$

The *target* of the rule is [−HIGH, −LOW]; the *structural change* is [+HIGH]; and the *environment* is defined as the position before [+NASAL]. Based on a treatment of segments as *set of features* and natural classes as *sets of segments*, we suggest an improvement to phonological notation. The representation [+NASAL] in our rule is interpreted as a variable x whose domain X is as follows:

(2) $X = \big\{x : x \supseteq \{+\ \text{NASAL}\}\big\}$

The intended meaning of the rule is "mid vowels become high vowels before an x", where x is a segment that includes the set of features {+NASAL} as a subset. So, X is a *set of segments*, and each segment in X is a *set of features* that is superset of {+NASAL}. Let's assume that this is the meaning of square brackets:

(3) $\big\{x : x \supseteq \{+\text{NASAL}\}\big\} = [+\text{NASAL}]$

Parallel interpretation applies to the targets. Using the formulation in (1), the target [−HIGH, −LOW] refers to a set of segments, each of which includes the set of features {−HIGH, −LOW} as a subset. Let's call this set Y and characterize it in standard set theoretic form, then traditional phonological form:

(4) $Y = \big\{y : y \supseteq \{-\text{HIGH},\ -\text{LOW}\}\big\} = [-\text{HIGH},\ -\text{LOW}]$

So, the target and the environment of a rule like (1) are characterized in terms of natural classes of segments characterized by a set of features that they all share (and no other segments in the language share).

We do *not* find parallel interpretation of the rule's structural change. It is clear that the structural change does not refer to a set of segments. In our example, the rule takes a *segment* y as an input, and outputs a different segment that is identical to y aside from the changed feature. We discuss various ways to formalize the change. The important point is just that in the rule, the change does not refer to a set of segments (each of which is a set of features), but rather to a set of features. We propose denoting it as such. Normal set notation makes use of curly brackets, { and }. We propose that we adopt the same notation in phonology, as follows:

(5) $[-\text{HIGH},\ -\text{LOW}] \rightarrow \{+\text{HIGH}\}]$ / ___$[+\text{NASAL}]$

The literature is inconsistent since it uses square brackets to represent sets of features (for example in characterizing a segment), and sets of sets of features (when characterizing a natural class of segments in a rule). However, by reserving curly brackets for sets, and using square brackets as the abbreviatory mechanism defined above, we achieve a more precise standard notation. We will show why this notational distinction is important by considering the problem of referring to underspecfied segments.

Korean POT and Aspiration: A Government Account

BARK Jieun, University of Nantes, jieun.bark@gmail.com

In this presentation, I examine how Korean tense consonants should to be considered as geminates: i.e. the realization of two underlying consonantal positions linked to a single object. This analysis has already been proposed by Kim-Renaud (1974), Choi (1995), Ahn & Iverson (2003). This argument is supported by both phonetic and phonological evidences. However, this analysis focuses only on geminates, yet disregards most of the other processes found in Korean, namely aspiration and final neutralisation, determining that they are unrelated. Our research demonstrates that *GP* (KLV 1985, 1990, Harris 1994, Scheer 1996, 2004) and Element Theory (*ET*, Backley 2011) is able to explain these behaviours and make significant generalizations if we assume that all these processes are linked.

1. ***Laryngeal dimensions and Post Obstruent tensing (POT).*** (1) provides examples of the three laryngeal dimensions used in Korean consonants: 1(d,e,f) shows that only lenis consonant are subject to intervocalic voicing. 1(g,h,i) shows examples of POT. Notice in 1(i) that aspirated stops cannot be tensed by a preceding obstruent.

(1)

Len. **a.** /pul/→ [pul] *fire*	**d.** /aka/ → [aga] *baby*	**g.** /hak+kyo/ → [hakk'yo] *school*
Tens. **b.** /p'ul/ →[p'ul] *horn*	**e.** /ak'a/ → [ak'a] *later*	**h.** /tak+t'oN/ → [takt'oN] *chicken pooh*
Asp. **c.** /pʰul/ → [pʰul] *grass*	**f.** /apʰa/ → [apʰa] *be sick*	**i.** /tak+tʰykim/ →[taktʰygim] *fried chicken*

Ahn (1992) proposes that POT inserts [+constricted glottis] in a consonant preceded by a [-son] consonant. Cho & Inkelas (1994) argue that POT contradicts the hypothesis that tense consonants are geminates; tenseness should not be triggered by two unrelated rules or configurations. In our view, POT is not feature insertion but rather association to the preceding consonantal slot, the geminate analysis remains. Evidence shows that this process is highly related to aspiration.

2. ***Obstruent Aspiration (OA).*** OA changes any lenis obstruent in its aspirated counterpart as soon as a glottal fricative is present in the immediate environment. 2(a,b) shows cases of final /h/, 2(c,d) of initial /h/ merging with the obstruent into an aspirated stop. Isolated forms (in 3) never exhibit aspiration:

(2)	**a.** /suh+tak/ →[sutʰak] *male chicken*	(3)	**a.** /suh/ → [su] *male*
	b. /anh+pak/→[anpʰak] *innner outer*		**b.** /anh/ → [an] *inner*
	c. /pɛk+ho/→ [pɛkʰo] *white tiger*		**c.** /coh/ → [co] *good*
	d. /pak+ha/ → [pakʰa] *mint (light+lotus)*		**d.** /apʰ/ → [ap] *front*

In order to explain those factors, we consider that OA results from the association of the obstruent with <H>. The structure must be licensed by the following nucleus as shown in (4):

(4)

a. plain
C V
x x

b. aspirated
license
C <<< V
x H x

c. final position
~~*license*~~
C v#
x H Ø

Example /apʰ/, in 3(d), is unable to express <H> in final position for the last vowel (v) of the associated template is empty (~~*license*~~): the structure must be abandoned and <H> *floats* (4c). Whereas in /pek+ho/ 2(c), the structure built from the association of <H> and the segmental content of /k/ is licensed by the following vowel /o/ (4b).

3. POT or OA**.** Tenseness is never attested in final position (5a-c): geminates must be licensed by the following expressed nucleus. v in (6b) is not a licit licenser, hence degemination.

(5)	**a.** /pak'/→[pak] outside	**d.** /apʰ+to/ →[apt'o]	*front*+coord.
	b. /tak'/→ [tak] wipe (stem)	**e.** /katʰ+canh+ta/→[katc'antʰa]	*despicable*+V+aux
	c. /k'ak'/→[k'ak] peel	**f.** /phatʰ+ka+lu/→[pʰatk'alu]	*red beans+powder*

(6)

a. tense
license
C v C<<<V
x x

b. final position
~~*license*~~
C v C v#
x Ø

c. asp. + tens.
license
C_1 v_1 C_2<<<V_2
x_i H x_j x

Now if we take a look at the examples in 5(d-f), we see that it is never the case that aspirated stops appear when there is POT. 6(c) depicts the process of deaspiration and tensening in the line of the proposition of Scheer & Zikova (2010). V_2 can license the geminate, but not the aspirated structure; v_1 the empty nucleus could still be governed by V_2 because it's empty, but will never be able to license its own onset, C_1.

This solution sheds light on the behaviour of forms like 1(i).

The Phonological Implications of Speech Rate Effects on VOT: English Revisited

Jill Beckman
University of Iowa

A growing body of research has identified asymmetric effects of speech rate manipulation on the realization of phonetic cues associated with the phonological features that characterize laryngeal contrasts. For example, Kessinger & Blumstein (1997) conducted an acoustic analysis testing the effect of speaking rate on VOT in word-initial stops in French, English, and Thai. French contrasts prevoiced (negative VOT) and short-lag VOT in stops, while English has a different two-way stop contrast: aspirated (long-lag VOT) vs. short-lag VOT. Thai has a three-way stop contrast: prevoiced vs. short-lag vs aspirated. Many phonologists have assumed that the three-way phonological contrast in Thai is one of privative [spread glottis] ([sg]), [voice], and [ø], whereas the two-way contrasts in French and English are [voice] vs [ø] in French and [sg] vs [ø] in English. K&B provide support for this distinction with their results. They found an asymmetric effect of speaking rate: as rate decreased, the amount of aspiration on word-initial stops increased in English and Thai and the amount of prevoicing increased in Thai and French, but there was little or no change in the VOTs of word-initial short-lag stops in any language.

Beckman, Helgason, McMurray & Ringen (2011) have argued that K&B's findings should be interpreted as evidence that *the phonetic cue(s) for only the active or marked feature(s) in a phonological contrast are selectively increased at slower speech rates.* Thus, voicing lead, a phonetic cue for the active phonological feature [voice], increased at slower speech rates in French and Thai. Long-lag VOT, a cue for the active feature [sg], increased at slower speech rates in K&B's English and Thai subjects. Short-lag VOTs did not increase at slower speech rates for any of K&B's subjects, supporting the notion that voiceless unaspirated stops are the unmarked phonological category—and that the laryngeal contrast in English is correctly characterized by [sg] vs. [ø] (rather than [voice] vs. [ø]). Beckman et al. provided support for their interpretation of K&B with a rate effect study of Swedish, a language in which the two-way contrast in stops is one of [voice] vs. [sg]—both laryngeal features are active in the phonology. Beckman et al.'s subjects exhibited an increase in *both* voicing lead *and* long-lag VOT in word-initial stops at slower speech rates—*phonetic cues for both of the phonologically marked categories changed as a function of speaking rate.*

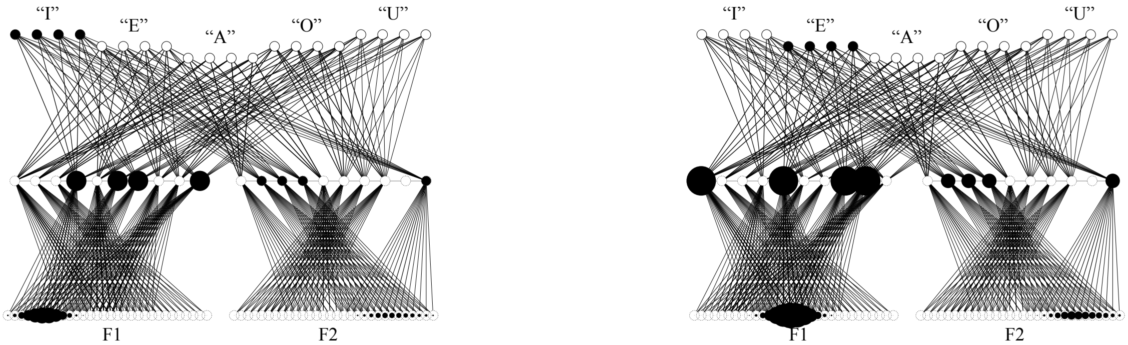
Kulikov (2012) applied the speaking rate paradigm to an investigation of VOT in Russian, a language in which the contrast is unambiguously [voice] vs. [ø]. Kulikov examined the effect of speaking rate on word-initial VOT, finding that voicing lead in word-initial stops increased at slower speech rates, but that short-lag VOT was unaffected. Kulikov also tested the effects of speech rate on stops in connected speech, examining both word-initial and word-medial stops in intervocalic contexts. Kulikov found that, as predicted by Beckman et al., *the phonetic cues associated with medial [voice] stops, but not unspecified stops, were also increased in slow speech*—the duration of voicing during closure was longer in medial [voice] stops produced in slow speech, but the duration of closure voicing in unspecified stops, and the VOT duration in these stops, was unaffected by rate differences.

In this paper, we report on speech rate effects on VOT and closure voicing in both initial and intervocalic stops in the speech of 16 college-age speakers of American English. It is well-known that the laryngeal contrast in English stops is typically realized as one of short-lag vs. long-lag VOT in initial position, and that the short-lag stops are often produced with some (passive) voicing in intervocalic position. If the English phonological contrast is, indeed, one of [sg] (Harris 1994, Iverson & Salmons 1995, Honeybone 2005, Beckman et al. 2011) rather than of [voice] (Keating 1984, Kingston & Diehl 1994, Wetzels & Mascaró 2001), and if Beckman et al. are correct in interpreting the relationship between phonological feature specification and speech rate, the prediction for English stops is clear: VOTs should increase in [sg] stops in slow speech both word-initially (replicating K & B 1997) *and intervocalically*, *but passive closure voicing in medial unspecified stops should not vary as a function of speech rate, because it is not a phonetic cue for a phonologically active feature.*

Learning phonological structures from sound-meaning pairs

Paul Boersma, Kateřina Chládková and Titia Benders

What kind of structures would emerge in a child's phonological representations if all that she is given during her acquisition period are pairs of sound and meaning? We investigate this question with the help of the smallest neural network model that can bear on this question: a neural structure with three levels of representation, namely a sound level, a meaning level, and a level in between, which we could label the "phonological" level:



In these pictures we see the same *adult* brain twice, activated with two different meanings. In the left picture, the meaning "I" is activated, which is shown as four *nodes* being switched on at the top left of the picture; in the right picture, the meaning "E" is activated instead. The meaning level is connected to the "phonological" (middle) level with a system of *connections*; these connections have the same strengths in the left and in the right picture (i.e. the two brains are the same). In the left picture, activating the meaning "I" activates four nodes in the left half of the phonological representation, and in the right picture, the meaning "E" activates four *other* nodes in the left half of the phonology. The four left-phonological nodes for "I" switch on a bunch of nodes at the left edge of the F1 (first formant) level in the sound, which means that the "I" word is pronounced with a low F1. The four left-phonological nodes for "E" switch on a bunch of nodes in the middle of the F1 continuum, which means that the "E" word is pronounced with a middle F1. In the left picture, activating the meaning "I" also activates four nodes in the *right* half of the phonological representation, and in the right picture, the meaning "E" activates the *same* four nodes in the right half of the phonology. The four right-phonological nodes for "I" switch on a bunch of nodes at the right edge of the F2 (second formant) level in the sound, which means that the "I" word is pronounced with a high F2. The four right-phonological nodes for "E" of course switch on the same nodes on the F1 continuum, which means that the "E" word is pronounced with the same high F2 as the "I" word. So we see that this speaker pronounces the "I" word as [i] and the "E" word as [e].

The adult brain of the pictures is a result of our computer simulation, where a virtual infant started with a brain consisting of very weak and random connections and was subsequently fed with thousands of sound-meaning pairs, with the word "I" always paired with an [i]-like sound, the word "E" always paired with an [e]-like sound, the word "A" always paired with an [a]-like sound, the word "O" always paired with an [o]-like sound, and the word "U" always paired with an [u]-like sound. The virtual child learned the strengths of the connections by using the "inoutstar" learning algorithm (Boersma, Benders & Seinhorst 2013). The resulting brain produces the five words in a similar way as it had heard in its language environment, as the two picture show. More interestingly, the patterns that emerged in the middle ("phonological") level can be interpreted as phonological features: in the pictures, for instance, we see discretely *different* behaviour in the left part of the phonology, which corresponds to "I"[i] and "E"[e] having the two different vowel-height features [high] and [mid], and discretely *identical* behaviour in the right part of the phonology, which corresponds to "I"[i] and "E"[e] sharing the same vowel-place feature [front].

We conclude that in this simple simulation, the structures that emerged in the intermediate level from sound-meaning pairs are *phonological features*.

A case study in the acquisition of Vowel Harmony in Brazilian Portuguese

Graziela Pigatto Bohn
University of São Paulo

This study investigates the acquisition of vowel harmony in Brazilian Portuguese, henceforth BP. In this language, a front or back mid-low unstressed vowel, /e/ or /o/, variably assimilates the [high] feature from a front or back high vowel, /i/ or /u/, in a subsequent syllable. For being variable, several are the studies which have set forth not only to describe the process but also to determine which contextual conditionings most trigger the assimilation. Among these conditions, Bisol (1981), Schwindt (1995, 2002) and Casagrande (2004) have attested that an intervenient dorsal consonant acts as a strong trigger in the process, an observation which is accounted for by the fact of velars being [+high] consonants (McCawley, 1967). Aditionally, all of the above studies have shown that the short-distance between the mid and high vowel is the most satisfactory conditioning for the raising of /e/ and /o/ in PB. That being so, /**me**di'sina/ is more likely to being surfaced as [midi'sina] while /**ʒe**la'tʃina/ is more resistent to the raising process. Besides that, high vowels which are within the word boundary, that is, not in suffixes, are also more favorable to spread the [high] feature. The data of this current study comprises words produced by one child acquiring BP during the period of 1;4 to 2;3. All of the words analysed have undergone a process of vowel harmony. The analysis has shown that few of her productions violate the phonological conditions of vowel harmony in BP, suggesting early mastery of the process. Among the results, we see in that at most productions the child targets the front and back mid vowels, with few exceptions occurring with the low back vowel /ɔ/. Also, the child violates only once the direction of the process, which is always regressive in PB, and favors assimilation between neighboring vowels, which is also more frequent in the language than assimilation between non-adjacent vowels. However, in BP, vowel harmony consists of partial assimilation of a height feature, and we have observed in this data evidence of total assimilation of height and place features, which happen to their most between 1;9 to 2;1 and decrease considerably towards 2;3. The analysis has also shown that the child, for a period between 1;9 and 2;0, disconsiders the unstressing condition of the target and will raise mid-low vowels in stressed position although satisfying directionality and contiguity.

In summary, the results show that this child's outputs seldom violate vowel harmony in BP, showing few productions which do not conform to the adult language. The results also suggest that the child is quite attentive to right-to-left directionality required in BP which is also cross-linguistically more robust than left-to-right segmental assimilations (Hyman, 2002:16). Contiguity also seems to bear a salient role in the acquisition of vowel harmony in BP.

Reference:

BISOL, L. **Harmonia vocálica: uma regra variável**. 1981. Phd Dissertation – Faculdade de Letras. Universidade Federal do Rio de Janeiro, Rio de Janeiro.

CASAGRANDE, G.P.B **Harmonização vocálica: análise variacionista em tempo real**. 2004. Master's Dissertation – Faculdade de Letras, PUCRS, Porto Alegre, 2004.

SCHWINDT, L.C.S. A regra variável de harmonização vocálica no RS. In: BISOL, L; BRESCANCINI, C.R. (orgs.). **Fonologia e variação: recortes do português brasileiro**. Porto Alegre: EDIPUCRS, 2002, cap. 4, p. 161-182.

SCHWINDT, L.C.S. **Harmonia vocálica em dialetos do Sul do País: uma análisevariacionista**. 1995. Master's disseration – Faculdade de Letras – Pontifícia Universidade Católica do Rio Grande do Sul, Porto Alegre.

MCCAWLEY, J. ([1967] 1972). The role of phonological feature systems in any theory of language. In V. B. Makkai. **Phonological theory: evolution and current practice**. New York: Holt, Rineh art & Winston, 522-52.

Tonal harmony in Bantu: A study on the mental representation of tone

Bettina Braun (Universität Konstanz) and Nancy C. Kula (University of Essex)

Bantu languages, like other African tone languages, are characterized by a complex interaction between lexically specified tones, tone spreading and downstep processes (Hyman & Kisseberth 1998). While there are a large number of phonological descriptions and analyses of Bantu tone, there are comparatively few studies on the mental representation of tone in these languages. In this study, we use the wug test (Berko 1958, Ratner & Menn 2000) to investigate lexical tonal representations and tone spreading rules in Bemba, which is argued to show both bounded and unbounded spreading of H tones (Bickmore & Kula to appear). Unbounded spreading involves H tone spreading through a domain if it is unimpeded by a following lexical H tone while bounded spreading involves restricted H spreading if another H tone or another constituent follow. Bounded spreading is argued to be either binary (Sharman & Meeussen 1955) or ternary (Bickmore & Kula to appear).

We recorded elicited production data from 20 Bemba native speakers (18-22 years from the Copperbelt province of Zambia) to investigate the domain of tonal spreading. Participants listened to infinitive forms of nonce verbs where a nonce verb stem (e.g. /sena/) followed the infinitive marker /ú̲ku/ (lexical high underlined). The stimuli were produced with an all-high pattern ([ú̲kúséná]), indicating a toneless nonce verb stem with unbounded spreading. Participants were asked to produce two novel forms, the 3rd singular future form (/á̲-ka-sena/) and a 3rd singular future form of the same verb with a following H-toned post-verbal clitic /kó/ (/á̲-ka-sena-kó̲/). The first production allowed us to test whether and how unbounded spreading is implemented for novel words; the second production targeted the realization of bounded spreading (caused by the H-toned suffix -kó̲). In total, there were 11 nonce verb stems (2-6 moraic), which were accompanied by pictures.

Productions were annotated by two trained listeners and a consensus representation was found. Preliminary results from 6 speakers showed the predicted unbounded spread in the 3rd singular future (e.g., /á̲-ka-sena/ produced as [á̲káséná]) in half of the cases only; the remaining productions had a downstep in the third syllable ([ákáꜝséná]). Surprisingly, these results were highly speaker-specific: two participants only had one or two items correct, while two participants had nearly all items correct. Analysis of tonal spreading in these correct cases showed a numeric preference for ternary spreading (39%), followed by binary spreading (35%). In 19% of the cases we also observed unbounded spreading, despite the H-toned suffix -kó̲.

Our results show that only half of the first productions were produced with the predicted unbounded spread. One explanation is that it was not easy for participants to infer the abstract tonal representation of nonce-verbs from the all-H surface form. If this is correct, tonal phonological rules appear to have a different status than segmental phonological rules (which could be tested in a subsequent experiment). Alternatively, the task of producing two different grammatical forms in close succession resulted in the insertion of a post-lexical H% boundary tone (like a continuation rise), which interacted with the lexical tonal representation. In this case downstep in the non *-ko* forms may have been caused by bounded (binary) spreading caused by the boundary H-tone. For the *-ko* forms produced with unbounded spreading this could indicate that the post-verbal clitic was not treated as an independent following constituent and its high tone was neutralized by heavy glottalization. In future studies we will compare tonal to segmental phonological rules and investigate the interaction between lexical and post-lexical tones more closely.

Carrarese's Syllable Structure: an OT approach to vowel reduction and epenthesis

Cavirani Edoardo – Università di Pisa & Leiden Universiteit - edoardo.cavirani@for.unipi.it

Resorting to OT framework, I describe syllable structure of Carrarese, an under-described Northern Italian dialect which underwent phonological vowel reduction processes such as syncope, apocope and, consequently, epenthesis, prosthesis and nasal vocalization (SILVĀTĬCU(M) > *səlvatko > *səlvatk > [sal'vatək] 'wild'; UMBĬLĪCU(M) > *ŋbəɖiko > *ŋbəɖik > [ŋ̩bə'ɖik] 'navel'; RE-FACTU(M) > *rfato > *rfat > [ar'fat] 're-done'). As a result, syllabic margins increased their licensing power: segments which occur in simple coda (Cd) position belong to every consonantal class; new complex onsets (O) can be found ([vri.'ta] 'truth', [vli.'noz] 'poisonous', [z.'gre.tsli] 'poor people'); and Cd clusters are allowed. However, Cd clusters are licensed only if respecting Sonority Sequencing Generalization (Blevins 1995), being instead 'repaired' by means of epenthesis if SSG is violated (HERBA(M) > [ɛrb] 'edible herb' vs. MĂCRU(M) > ['magər] 'slim'). Because of asymmetries observable between O and Cd licensing power, however, SSG turns out not to be adequate for the description of syllable margins: as far as sonority is concerned, consonants within clusters can be closer in Cd ([tsolf] 'sulphur', [taŋf] 'stink') than in O ([flip] 'maid of honour' but *[fnit] 'finished').

Generalizations just presented are accounted for by an OT grammar: a functionally well-justified (Vennemann 1988) markedness constraint which assigns a preference for shorter forms favouring syllable deletion, *STRUC(σ) (Zoll 1998; Miglio 2005), must be higher ranked than the faithfulness constraint which blocks vowel deletion, MAX-V (Kager 1999; McCarthy 2008), but lower than the one which blocks stressed vowel deletion, MAXPROSHEAD (Wheeler 2007). This way, only unstressed vowels can be deleted in the process of input-output mapping. Furthermore, *STRUC(σ) must dominate *COMPLEX and *CODA (Prince & Smolensky 1993[2004], Krämer 2009): the pressure toward unstressed vowel reduction is higher than the one towards unmarked syllable structures. At the same time, *STRUC(σ) has to be ranked relatively to markedness constraints which order tauto-syllabic consonant clusters' sonority contour in a universal hierarchy: *SD-4 >> *SD-3 >> *SD-2 >> *SD-1 >> *SD0 >> *SD+1 >> *SD+2 >> *SD+3 >> *SD+4 (adapted from Montreuil 2000). This means that syncope is blocked if it results in an output form with a consonant cluster which violates one of the relevant *SD constraints. Similarly, if apocope deletion process applies and an ill-formed consonant cluster is produced, a vowel is epenthesized if this way *SD constraints are fulfilled. Hence, a faithfulness constraint which penalizes epenthesis, DEP-V (McCarthy 2008), must be lower ranked with respect to constraints that govern consonant cluster well-formedness. As for O/Cd asymmetry, it is accounted for by *SD constraints' sensibility to prosodic domain: the markedness constraint that penalizes Cd cluster with a SD≤1, $*SD_{Cd}+1$, must be ranked below DEP-V, which in turn must dominate the markedness constraint that penalizes O cluster with the same sonority distance, $*SD_{On}+1$. This way, epenthesis applies only if the consonant cluster with a sonority distance of 1 is an O, being instead blocked if it is a Cd. Finally, an undominated faithfulness constraint, MAXMORPH (Miglio 2005), must be introduced which blocks apocope if "endangered" vowels are morphologically significant (/magr/ > [ma.gər] 'thin (m.)' vs. /magr/+/a/ > [ma.gra] 'thin (f.)').

Thanks to the OT approach just presented, hence, static generalizations concerning syllable structure (phonotactics), as well as dynamic processes which increase its complexity (apocope and syncope) and "repair" ill-formed structures (epenthesis and nasal vocalization), can be accounted for by a single system, i.e. by a hierarchy of independently motivated universal constraints.

On the phonotactics of reduplication

András Cser, Pázmány Péter Catholic University
cser.andras@btk.ppke.hu

This paper looks at the demise of perfective reduplication in Latin and seeks to answer the question why this process of erosion followed a phonologically strictly defined path. The small set of remaining reduplicated perfects is not a random collection of leftovers from the ruins of earlier morphology (as it is in Gothic), but in including mostly stems beginning with voiceless stops, it displays remarkable phonological coherence in the documented period of the language. To understand why this should be so we look at the relevant phonotactic properties of simplex forms. It appears quite clearly that, for a variety of reasons, the number of stems beginning with **p**V**p**, **t**V**t**, **k**V**k**, **b**V**b** and **s**V**s** increased in the prehistory of Latin. The fact that this occurred and that voiceless stops figure more prominently in this configuration than other types of consonants may well have given rise to a new phonotactic pattern in which such stem-initial sequences were now legitimate (as opposed to Proto-Indo-European). It seems to be a plausible explanation that perfective verb forms remained reduplicated only if they conformed to this new phonotactic pattern.

The previous, seemingly self-explanatory accounts based on sound changes, as proposed by Sommer (1902:596) and adopted by Meiser (2003:154–155 and passim), are not without problems. They do not take account of analogical restitution and novel formation, both attested in Latin. They also do not account for the complete absence of e.g. **n** from the set of reduplicating consonants. Simple frequency data also do not appear to explain the preponderance of voiceless stops.

We look at the behaviour of consonant-initial prefixes for a possibly informative comparison. We point out that those prefixes which do not correspond to a preposition display an ″anti-reduplication effect″, i.e. they never combine with stems beginning with the same consonant as the prefix itself. This we attribute to the same phenomenon: the analogical pull of stems, which makes the hypothetical sequences resulting from same-consonant prefixation phonotactically illicit. The same interference does not affect prefixes with corresponding prepositions (the typical case), since the phonological freedom of the relevant free forms counterbalances the phonotactic constraint with a different kind of analogical force. The net result is that the same underlying diachronic process seems to be operative in both domains of Latin pre-stem morphology: the inclusion of reduplication as well as ″atypical″ prefixation in simplex (stem-level) morphophonology. The discussion thus highlights an interesting contrast between Proto-Indo-European and Latin. While in Proto-Indo-European the phonotactic ″irregularity″ of reduplication, i.e. the phonological contrast between root-initial sequences and reduplicated sequences, enhanced the perceptual salience of reduplicated forms and thus helped generalise and maintain reduplication as a multifaceted morphological device, in Latin the opposite happened: it was phonotactic ″regularity″, i.e. conformity to the phonotactic patterns of stems that helped maintain a small set of reduplicated perfects until the complete reshuffling of Latin morphology and phonology as the language was replaced by Romance.

Frequency of use and expressive palatalization: Allomorph distribution of Polish diminutives

Bartłomiej Czaplicki
University of Warsaw
bczaplicki@uw.edu.pl

Polish diminutives are formed with two distinct suffixes *+ek* ([ɛk]) and *+ik/yk* ([ik], [ɨk]). Although some phonology-related tendencies can be identified with respect to the base-final consonant (velars tend to prefer *+ek*, while coronals predominantly appear with *+ik/yk*), hard and fast rules of the distribution of the two suffixes are unstatable. A great majority of base-final consonants allow both suffixes and the choice between them appears to be lexically idiosyncratic, e.g. *słu*[p] 'pole' – *słu*[p]*+ek* vs. *skle*[p] 'shop' – *skle*[pʲ]*+ik*, *sy*[n] 'son' – *sy*[n]*+ek* vs. *dywa*[n] 'carpet' – *dywa*[ɲ]*+ik* and *kefi*[r] 'kefir' – *kefi*[r]*+ek* vs. *teat*[r] 'theater' – *teat*[ʃ]*+yk*.

Since language is a dynamic system, valuable insight about diminutive allomorphy can be gleaned from the direction of pattern extension in recently borrowed words. It is proposed that an explanatory and predictive account of the direction of pattern extension must consider two factors: frequency of use and expressive palatalization.

Under the view that language is a system that responds to frequency distributions of variants in the input (Pierrehumbert 2002), it is hypothesized that the choice of the shape of the suffix for each base-final consonant is determined by relative type frequency. However, it is shown that frequency of use is not sufficient as it correctly predicts the direction of extension for some base-final consonants (e.g. velars) but not for others. For example, in well-established words labials predominantly appear with *+ek* but in recent words a form with *+ik* is favored in this context. This is taken as evidence for the existence of a pressure that in this case countervails the impact of frequency of use, expressive palatalization (EP).

EP exploits the iconic associations between sound and meaning. It corresponds to the high acoustic frequency that characterizes palatal(ized) consonants and certain front vowels (as well as high pitch) (Ohala 1994, Kochetov & Alderete 2011) and connotes the meaning of "smallness", "childishness" and "affection". Direct evidence for an active role of EP in Polish is identified in hypocoristics and certain unexpected patterns in diminutive formation. In the latter case, a well-established morphophonological pattern is being replaced by a novel pattern showing EP.

It is demonstrated that frequency of use and EP interact in conditioning the pattern extension of diminutives. Cases are identified when EP is mute (due to a sound change that eliminated the phonetic cues of palatalization) and frequency of use plays the major role. On the other hand, when the role of frequency of use is diminished (the pattern is not very robust), EP comes to the fore. Particularly interesting are those cases which show the impact of both pressures. Here a trading relation is visible. The degree of entrenchment of a pattern (its robustness) is inversely related to the impact of EP.

In addition, the results are consistent with the findings that grammars are highly redundant and speakers rely on low-level schemas, rather than on more general (and more economical from the point of view of the requirements of a formal linguistic theory) rules (Dąbrowska 2008).

Categorical versus Stochastic Generalizations and the Nature of Variation in Morphophonology

Brent de Chene, Waseda University (dechene@waseda.jp)

Recent literature shows that speakers have knowledge of many statistical generalizations about the distribution of linguistic forms, where the latter range in size at least from segments (Frisch et al. 2000) to constructions (Bresnan 2007). Such generalizations can be stated across a lexicon or corpus as a whole (e.g. "roughly 10% of Spanish mid vowel verb stems diphthongize") or can be relativized to microenvironments (e.g. "27% of 1st conjugation verbs with stem vowel *e* before *nt* diphthongize" (Albright et al. 2000:8)). In this talk, restricting the domain of inquiry to pan-lexical generalizations about non-automatic (morphophonological) alternations, I will contrast two visions of how such statistical knowledge is incorporated into the phonology, assuming for expository purposes a rule-based framework. On the first, lexical statistics are phonologized as stochastic rules whose strength is proportional to their lexical prevalence, so that if an alternation (including the null alternation) applies to 50% of eligible lexical units (stems or affixes), it will have, to a first approximation, a 50% chance of applying to an innovative unit of the same kind (Zuraw 2000, Becker 2009, Albright 2009). Call this the "Proportional Representation" (PR) theory of morphophonology. On a second, "Winner Take All" (WTA) theory, only the strongest pattern of alternation (Albright 2005:41) is taken as regular and (if non-null) entered into the phonology as a rule; other patterns are taken to be irregular, marked as such in the lexicon, and are subject to reduction or elimination over time. On the PR theory, then, morphophonology consists of stochastic generalizations, while on the WTA theory, it consists of categorical generalizations plus lexical indications of exceptionality. As a representative test case, I will consider a state of affairs that has recently been analyzed in terms of the PR theory, variability in the final consonants of Korean noun stems (Jun 2010), and argue that it is in fact the result of the WTA theory; crucial evidence will be that the variation in question is effectively limited to certain stem-types and has a distinctive diachronic profile, both facts which receive a ready explanation under the WTA theory but are unexpected under PR.

More precisely, consider a situation in which, over a well-defined set of stems or affixes, X in context A alternates as a function of the stem/affix with multiple Y_i (i = 1, 2, ..., n) in context B, where there is reason to believe that X is underlying; this situation is relatively common as a result of "diachronic deneutralization", whereby formerly derived forms showing neutralized values of some feature are reanalyzed as underlying because of their salience (e.g. high type frequency or status as isolation forms). If $Y_i = X$ for some i, call that Y_i "Y_0"; the alternation $X \sim Y_0$ is then the null alternation. For example, in the set of Korean noun stems defined by the property of ending in /k/ before syllable boundary (i.e. word-finally or before a C-initial suffix), the /k/ alternates with /k/ when syllable-initial (i.e. before a V-initial suffix) in one subset of stems (the great majority), but with /k^h/ in a second subset, with /k'/ in a third, and with /ks/ and /lk/ in two more. Further, assume that in this situation, the alternation $X \sim Y_i$ is stable for one Y_i, call it Y_R (mnemonic for "regular"), while the remaining Y_i display variation between Y_i and Y_R, with the proportion of Y_R increasing over time. In that case, I claim, it can be inferred that speakers have made a categorical judgement that the alternation $X \sim Y_R$ is regular; the gradual replacement of other Y_i by Y_R (leveling if $Y_R = Y_0$, extension otherwise) is naturally interpreted as loss of the lexical specifications of irregularity that are responsible for the irregular alternations. In such a case, then, variation, rather than being the result of speakers' positing multiple stochastic rules, as the PR theory would have it, is a stage on the road to elimination of irregular forms, as per the WTA. Using data from the Sejong corpus (www.sejong.or.kr; Kim and Kang 2000, 2004) and from searches of the internet (where token frequencies are four to five orders of magnitude higher than in the corpus), I will claim that almost all of the attested variation in contemporary Korean noun inflection is to be understood on this model. I also argue that, if conflict arises, data of the sort appealed to here, which involve unselfconscious inflection of actual words, should be given greater weight in making inferences about speakers' internalized grammar than data involving elicitation or evaluation of nonce forms.

An Optimality-Theoretic Account of the Production of Word-Final [m, n] by L1 English – L2 Brazilian Portuguese learners

Miley Antonia Almeida Guimarães
Universidade de São Paulo (USP)
miley.guimaraes@gmail.com

In Brazilian Portuguese (BP) the simplex nasal codas [m, n] only exist as a result of regressive assimilation – the final /N/ assimilates in place of articulation to a following bilabial or alveolar/dental consonant – whereas in L1 English–L2 BP, these nasal stops can also be found in absolute word-final position as well as preceding heterorganic segments. I argue that the production of final [m, n] by L1 English–L2 BP adult learners in contexts not permitted in BP is not merely due to orthographic interference, but it could be construed as the learners' attempt to produce the Portuguese nasal vowel by the inclusion of an adjacent nasal consonant. It is assumed here that such process can be made explicit through a standard optimality-theoretic account (Prince & Smolensky, 1993; McCarthy & Prince, 1995).

The Portuguese nasal vowel, which has a contrastive function, is generally assumed to be a sequence constituted of a vowel and an underlying nasal consonant (VN). Phonetically, /N/ agrees in place of articulation with the contiguous segment. If VN precedes a stop, either within or between words, the assimilation is usually regressive; e.g. l[ẽn]da *lenda* 'legend', s[ɜ̃ŋ]gue *sangue* 'blood', b[ɜ̃m] melhor *bem melhor* 'much better'. In case VN precedes a fricative, a vowel or a pause, the assimilation is necessarily progressive – to the preceding vowel – e.g. d[ẽɲ]so *denso* 'dense', b[õŋ] emprego *bom emprego* 'good job', tamb[ẽɲ] *também* 'too'. In the particular dialect of Portuguese spoken in the city of São Paulo, the production of VN as V+glide is the most common in word-final positions, e.g. b[õw], tamb[ẽj].

In describing spontaneous speech data from eleven L1 English–L2 BP adult learners (six Americans and five English) residing in the city of São Paulo, it has been found that ten learners produced the final nasal stops [m, n] in contexts that are not permitted in BP. The production of these nasal stops as word-final consonants has been demonstrated to correlate with the learners' length of residence in the country (3 months: 0.97; 2-3 years: 0.19; 9-11 years: 0.14; 20-31 years: 0.59, as statistically measured via *GoldVarb*). It is important to note that this aspect of the learners' interlanguage can affect their speech intelligibility. In Portuguese, word-final consonants are usually resyllabified as the onset of the following vowel-initial word, therefore *um ano* 'a/one year' produced by the L2 learner as 'u[m] ano' can be easily misinterpreted as *humano* 'human' by a BP native speaker.

This study asserts, using the data above, that the production of word-final [m, n] before pause and heterorganic segments, which occurs frequently in the speech of L1 English–L2 BP beginning learners, is the result of L1 ranking transfer. In the L1 English–L2 BP initial interlanguage, AGREE constraints that require word-final nasal assimilation to the following word-initial stop or to the preceding vowel (AGREE CC and AGREE VC, respectively) can both be violated, which may occur in English but not in BP. In contrast to BP, which has /N/ as a floating autosegment, I argue that the learner's initial interlanguage has the nasal consonant specified either as /m/ or /n/, and has the faithfulness constraint IDENTPLACE-IO occupying a dominant position in the ranking. This aspect of the initial interlanguage is consistent with the L1 ranking transfer hypothesis (Pater, 1997; Broselow et al., 1998; Davidson et al., 2004; Hancin-Bhatt, 2008). Finally, an interesting phenomenon occurs with the inclusion of [m, n]: while the presence of these nasal stops produce a more complex syllabic structure, it also exemplifies the emergence of the unmarked, as it enables the learner to more effectively produce the required nasalization of the vowel due to the dominance of $*V_{oral}N$.

The Diachrony of Epenthesis

Mark Hale & Madelyn Kissock
Concordia University, Montréal

In a soon-to-appear paper, de Lacy and Kingston present a detailed consideration of markedness and epenthesis, arguing that the history of the Hawai‘ian reflex of the default form of the Proto-Eastern Polynesian *Cia suffix presents a clear case of the need for ‘synchronic explanation’ — i.e., a case in which ‘diachronic explanation’ fails without the invocation of a central role for UG in shaping the nature of human grammars. While sympathetic to the basic point of the argumentation offered (UG exists and can be seen to play itself out in diachrony), Hale & Kissock (2012) presented a re-evaluation of the empirical foundation for the claims in de Lacy and Kingston (forthcoming) and found them wanting.

In particular, for a quick summary, de Lacy and Kingston argued that: (1) Maori has a rule of [t]-epenthesis to break certain vowel hiatuses; (2) closely related Eastern Polynesian sister Hawai‘ian shows a change of Proto-Eastern Polynesian *t to /k/; (3) one might therefore expect (since Maori *t comes from Proto-Eastern Polynesian *t) that Hawai‘ian would show [k]-epenthesis (with [k]< PEPn *t); (4) Hawai‘ian does not, showing [ʔ]-epenthesis instead; and (5) this is because UG does not allow human languages to have velar epenthesis (for markedness reasons), so when Hawai‘ian *should have* ended up with velar epenthesis, it *had to* revert to epenthesis of the less-marked glottal stop instead (Hawai‘ian has no /t/, of course). Hale & Kissock argued in detail that, while claim (2) is true, the empirical claims in (1), (4), and (5) are all poorly supported by the available evidence, and thus the chain of reasoning does not go through.

In the present paper, we explore in detail claim (3), walking through the expected outcomes of a situation in which a language has [t]-epenthesis at Stage I and a change of *t>/k/ at Stage II, given an explicit theory of language change which makes provisions for (1) an Ohala-esque theory of sound change and (2) a role for UG as a constraining system on developments under (1). We show what we believe would be expected under two sets of conditions: a set in which UG allows for velar epenthesis in human languages, and set in which it does not. From the set of scenarios which arise under a careful consideration of the diachronic possibilities, we conclude that the argument offered by de Lacy and Kingston (forthcoming) fails even under the assumption of a UG ban on velar epenthesis: i.e., even if the synchronic facts of Proto-Eastern Polynesian and modern Hawai‘ian were as depicted by de Lacy and Kingston, one cannot conclude that a synchronic ban on velar epenthesis would lead to the contemporary Hawai‘ian situation. There is simply no necessity that an acquirer maintain an analysis that a given segment is epenthetic, simply because it was epenthetic in the speech of his or her sources. The attested diachronic development of known cases of epenthesis are shown to bear no relationship to the path envisioned by de Lacy and Kingston’s paper.

Expansive and Regressive Patterns in Valencian Vowel Harmony

Ricard Herrero & Jesús Jiménez
Universitat Catòlica de València & Universitat de València
Ricard.Herrero@ucv.es & Jesus.Jimenez@uv.es

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* /ˈtɛra/ [ˈtɛrɛ] 'land', *cosa* /ˈkɔza/ [ˈkɔzɔ] 'thing'). In the prototypical case both /ɛ/ and /ɔ/ trigger feature spreading to posttonic /a/; however, there are varieties which only display Front or Round harmony. In previous works, it has been assumed that the process 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 (cf. Recasens 1991, Jiménez 1998, 2001). Another crucial assumption is that Valencian vowel harmony targets Color features; hence, the leveling of height features between the stressed and the final vowel would be a parasitic effect of Color harmony (cf. Jiménez 1998).

In this work, we will focus on three varieties of the Northern Valencian dialect: the variety of Nules and the variety of Borriana as spoken by old and young people. We will analyze, firstly, the realization of the stressed round mid vowel /ɔ/ and the realization of /a/ in posttonic final position in potentially harmonic words such as *cosa*. Secondly, we will study the same sequence of vowels across morphological boundaries, as in *correspon-la* 'reply to her', and across words, as in *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 a mid round [RTR] vowel and /a/ affects the values of both the stressed and the final vowels and to measure the degree in which the presence of morphological and word boundaries affects the intensity of the assimilation. A second goal of the paper is to discuss whether the behavior displayed by all three varieties let us assume a diachronic evolution in the patterns.

The results show that there is Round vowel harmony in the context /ˈɔ/+/a/ among old speakers in the Borriana variety. The assimilation is total within the word (e.g., *cosa* [ˈkɔzɔ]) and, less consistently, in the clitic group (e.g., *correspon-la* /korresˈpɔn#la/). Across words, we find 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. Among young speakers in the Borriana variety, though, vowel harmony seems to be a receding pattern: this variety displays an array of coarticulation effects more alike to those found in Nules, although with some lexicalized items. On a different level, the results show that, in all sequences of a round vowel plus a low vowel, /a/ is distinctly more closed in every variety than unstressed /a/ in the non-hamonic environment /ˈa/+/a/ (e.g. *casa* [ˈkaza] 'house'); there is, then, a leveling of height independent from, and probably prior to, vowel harmony.

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 amongst old speakers 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. The change detected from old to young speakers in Borriana seems to reverse this tendency, returning somehow to the starting point. Hence, while Nules seems to represent a

Recognize: ['rekəgnaɪz] ['rekənaɪz] [rekəg'naɪz]
On the phonology of coexisting variant forms

abstract – mfm21, Manchester, 23-25 May 2013

Daniel Huber
Université de Toulouse, France
dhuber@univ-tlse2.fr

The verb *recognize* has a number of variant pronunciations. This paper investigates how these variants emerged and what they tell us about the phonology of English today. The probably most widespread variant, ['rekəgnaɪz], is commonly accounted for in terms of non-transparent derivation by *-ize* with antepenultimate stressing (eg, Ginésy 2004: 126, Nádasdy 2006: 222). Wells (2008), however, lists two further attested pronunciations for *recognize*. One is found in “British English but non-Received Pronunciation” and where stress is final: /rekəg'naɪz/. The other one is a pronunciation “generally considered incorrect”: /'rekənaɪz/, that is without /g/. This /g/-less pronunciation is listed as a regular variant in LDOCE (2009).

The variant with final stress is relevant for a discussion of the phonological behaviour of the suffix *-ize* since this is clearly not a mainstream pattern in contemporary RP but it sheds light on the history of stressing with this suffix. In this form, *-ize* is a stress-attracting suffix, much like *-ese.*

The /g/-less pronunciation of *recognize* is worth examining in even more detail. From the perspective of traditional letter-to-sound rules, this /g/-less form is curious because it does not conform to any established pattern of “silent <g>”. A detailed typology of the spelling and pronunciation of attested words with silent <g> will be presented to support this observation (data: Nádasdy 2006: 82, Sobkowiak 2004: 120, Wells 2008). It will then be suggested that a phonological explanation should exist to account for this variant. This tentative explanation involves the suffix *-ize*, and the form can be analyzed as a special case of non-transparent derivation.

According to the OED, *recognize* is first attested in 1388/89 in English so it is not a recent borrowing. Nevertheless any indication as to its pronunciation comes from much later: Walker (1791: 45) makes this comment on its usage: “Some affected speakers, either ignorant of the rules for pronouncing English, or over-complaisant to the French, pronounce *physiognomy, cognizance* and *recognizance*, without the *n* [he must mean <g> here, not <n>, DH]; but this is a gross violation of the first principles of spelling.” While this may indeed account for how the /g/-less variant emerged (and why it is considered “incorrect” today by prescriptivist standards), there seems to be much more at issue.

It will be argued that the pronunciation of *recognize* without /g/ is a good indicator that *-ize* is a neutral suffix here: this variant comes, phonologically speaking, from /'rekən/ # /aɪz/ > /'rekənaɪz/. The form /'rekən/ is incidentally an attested free-standing phonological form in English: <reckon>. While the two words are etymologically distinct, from a phonological point of view the form /'rekənaɪz/ looks as if derived from **reckon* > *reckonize*, preserving the stress of the stem. It is a case of non-transparent derivation that accommodates *reckon* to serve as its phonological (and semantic) base.

References
Ginésy, Michel. 2004. *Mémento de phonétique anglaise*. Armand Colin.
Longman Dictionary of Contemporary English. 2009 (5th edition). Pearson–Longman.
Nádasdy, Ádám. 2006. *Background to English Pronunciation*. Budapest, Nemzeti Tankönyvkiadó.
Sobkowiak, Włodzimierz. 2004 (2008). *English Phonetics for Poles*. Poznań, Wydawnictwo Poznańskie.
Walker, J. 1791. *A Critical Pronouncing Dictionary.* London: G.G.J. and J. Robinson, and T. Cadell.
Wells, J C. 2008 (3rd edition). *Longman Pronunciation Dictionary.* Pearson–Longman.

Representing the Dutch vowel system: phonological structure and phonetic content

Mirjam J.I. de Jonge, University of Amsterdam, m.j.i.dejonge@uva.nl

The acoustic realisations of Dutch vowels exhibit systematic differences in duration and formant structure. While the mapping between these observable properties and the presumed phonological representations is complex, I will show that phonetic properties of Dutch vowels follow in a straightforward way from constraints on the *content* of phonological representations, while metrical properties of the Dutch vowel system follow from the *structure* of phonological representations. The proposed analysis thus entails a division of labour between structure and content to account for different domains of the grammar.

<table>
<tr><td>(1)</td><td>i</td><td>y</td><td>u</td><td>(2)</td><td>a</td><td>e</td><td>ø</td><td>o</td><td>i</td><td>y</td><td>u</td><td>ɛɪ</td><td>œy</td><td>ɔu</td></tr>
<tr><td></td><td>ei</td><td>øy</td><td>ou</td><td></td><td>|</td><td>|</td><td>|</td><td>|</td><td>|</td><td>|</td><td>|</td><td>/ \</td><td>/ \</td><td>/ \</td></tr>
<tr><td></td><td>ɛɪ</td><td>œy</td><td>ɔu</td><td></td><td><u>A</u></td><td>A</td><td>A</td><td>A</td><td></td><td></td><td></td><td>A</td><td>A</td><td>A</td></tr>
<tr><td></td><td></td><td>a:</td><td></td><td></td><td></td><td><u>I</u></td><td><u>I</u>,U</td><td><u>U</u></td><td><u>I</u></td><td><u>I</u>,U</td><td><u>U</u></td><td>I I</td><td>I,U I,U</td><td>U U</td></tr>
</table>

Looking at the set of Dutch vowels that can occur word-finally (1) we find differences in length and formant stability: 3 vowels are short [i y u], 3 are diphthongised [ei øy ou], 3 are diphthongs [ɛɪ œy ɔu], and one is a long monophthong [aː]. Respresenting vowel quality with configurations of Elements (Backley, 2011) in (2), the length and stability properties in (1) follow directly from (3). 3a captures the observation that all non-close vowels surface as long vowels; 3b expresses the limited complexity that is allowed in the second part of a long vowel.

(3) a. A non-empty A-tier creates a duplicate vowel
b. Vowel duplicates allow content in one tier only

The above accounts for the phonetic properties of Class II vowels /a e ø o i y u/ (Moulton, 1962), but not for Class I vowels /ɑ ɛ ɪ ʏ ʊ/ which cannot occur word-finally. Botma and Van Oostendorp (2012, B&O) revived the idea that the difference between Class I and II is expressed in lexically specified syllable structure rather than as a feature shared by all vowels in a class (cf. Sievers, 1901), with Class I vowels surfacing in branching rhymes and Class II in non-branching rhymes. This provides a constituent structure that is consistent with the metrical structure of Dutch, particularly the counter-intuitive syllable weight and associated stress patterns (Gussenhoven 2000; Van der Hulst 2003).

However, unlike B&O seem to propose, these structural specifications are not enough to account for the quality differences of Dutch vowels. B&O assume that Class I and Class II vowels are representationally identical, but it doesn't specify which Class I and Class II vowels share a representation. Because current Dutch exbihits no systematic Class I-Class II alternations, identifying representationally identical vowels across classes is problematic. Structure alone can only explain metrical structure, but surface quality requires further specification of representational content.

Given the lack of alternations in Dutch, learners of the language need other evidence to develop a systematic representation of vowel quality. Measuring the perceptual distance between vowels (e.g. between /i e ɛ ɪ/) for native speakers of Dutch could determine whether there are indeed representationally identical Class I-Class II pairs in Dutch phonology, or whether Class I and Class II vowels need to be represented independently.

Accounting for deletion in (some) Picard coda clusters (but not others) when MAX outranks DEP

Brian José (*the University of Glasgow*) – *bjose@alumni.indiana.edu*
Julie Auger (*Indiana University*) – *jauger@indiana.edu*

In Optimality Theory (Prince and Smolensky 2004 [1993]), if MAX outranks DEP in a given language's constraint hierarchy, then illicit consonant clusters will be repaired by vowel epenthesis. Or, if ⟦MAX » DEP » MARKEDNESS⟧, they will surface faithfully; but whatever the ranking of MARKEDNESS, cluster reduction should not occur, as this violates higher-ranking MAX and satisfies lower-ranking DEP.

This paper deals with the unexpected simplification of word-final obstruent–liquid clusters in a language where illicit clusters are normally resolved by means of vowel epenthesis. The language in question is the endangered Romance language Picard, where obstruent–obstruent clusters that fail to satisfy sonority sequencing requirements for complex onsets and codas are syllabified heterosyllabically either with (1) or without (2) an epenthetic vowel, depending upon whether the following segment is a consonant or a vowel. The impossibility of deletion in (1), *[tris.vi], shows that MAX outranks DEP. The challenge, then, is explaining why high-ranking MAX is violated and low-ranking DEP is satisfied in forms like those in (3). (It can be noted, though, that vowel epenthesis is, in fact, attested in such forms, but only about 10% of the time; most often, about 85% of the time, these coda clusters exhibit reduction. The remaining approximately 5% of the time, they surface faithfully as marked, rising-sonority codas. This variation, although not the focus here, can be captured by allowing for the variable re-ranking the relevant constraints following Anttila & Cho 1998, Boersma & Hayes 2001, and others.)

(1)	/ trist # vi /	➛	[tris.te.vi]	*tristé vie*	'sad life'
(2)	/ trist # eto /	➛	[tris.te.to]	*triste étot*	'sad state'
(3)	/ øtr /	➛	{ [øt]	*eute* }	'other'
			*[øtre]	**eutré*	

To account for these facts, we call upon constraints against particular combinations of segment types occurring as complex onsets and complex codas, implemented in the Split Margin Theory of syllable structure (Baertsch 2002) and multiplied according to Comparative Markedness Theory (McCarthy 2003). This yields constraints against both 'old' and 'new' obstruent–liquid codas, both 'old' and 'new' obstruent–liquid syllable contacts, both 'old' and 'new' obstruent–liquid onsets, among others. Forms like those in (3) exhibit cluster reduction because the constraints against 'old' obstruent–liquid codas (*[øtr]), 'new' obstruent–liquid syllable contacts (*[øt.re]), and 'new' obstruent–liquid onsets (*[ø.tre]) all outrank MAX. Since MAX is the lowest-ranked of the relevant constraints, deletion is optimal ([øt]). Other clusters (e.g., obstruent–obstruent clusters) are subject to distinct comparative markedness constraints which are dominated by MAX; therefore, they are not simplified.

As a final observation, additional related problems of Picard syllable structure find explanations in this analysis. For example, without invoking systematic extra-metricality, it straightforwardly rules out word-internal coda clusters while still allowing them word-finally. Similarly, it accounts for why falling sonority clusters such as /rl/ and /rn/ sometimes surface as perfectly well-formed tautosyllabic codas and other times surface with vowel epenthesis as heterosyllabic clusters (e.g., [perl] ~ [per.le] 'speaks'; [torn] ~ [tor.ne] 'turns').

Neither necessary nor sufficient: Rethinking the role of contrast in vowel harmony.

Wendell Kimper // University of Manchester // wendell.kimper@manchester.ac.uk

In languages with vowel harmony, all vowels within a given domain must agree with respect to some particular feature. However, very few languages with vowel harmony exhibit the Platonic ideal of the process. Most include segments which behave as though they are immune to the harmony restriction, introducing disharmonic sequences into a system otherwise characterised by agreement. In Yoruba, for example, high vowels [i] and [u] do not undergo tongue root harmony. (Archangeli and Pulleyblank, 1994; Bakovic, 2000; Casali, 2008; Pulleyblank, 1996; Orie, 2001, 2003). One particularly common analysis of this phenomenon depends crucially on the notion of contrast — a segment will fail to obey harmonic restrictions if and only if it lacks a contrastive counterpart in the inventory of the language (Vago, 1976; Archangeli and Pulleyblank, 1994, and many others). Under this explanation, high vowels in Yoruba are ineligible for harmony because the inventory lacks the [−ATR] counterparts [ɪ] and [ʊ]. This approach has achieved widespread use because it successfully captures the majority of cases; many languages do in fact show a close relationship between non-participation in harmony and contrastive pairing in the inventory.

In this talk, however, I argue that this relationship is not quite as close as it seems — *in particular, the lack of a contrastive counterpart is neither necessary nor sufficient to produce non-participation in vowel harmony.* This provides further evidence in favour of a view of phonological inventories as another result of the same forces that shape phonological processes, rather than as objects to which those processes refer.

Crucially, a segment may lack a contrastive counterpart, yet still undergo categorical harmonic alternation. In Kinande, for example, the low [−ATR] vowel [a] does not contrast phonemically with its [+ATR] counterpart [ʌ], which cannot occur in monosyllables and only surfaces when conditioned by harmony. Gick et al. (2006) provide evidence from both acoustic measurement and ultrasound imaging which strongly suggest that the [a]∼[ʌ] alternation is categorical, and not the result of phonetic interpolation. In particular, the difference in tongue position between the two variants is comparable in magnitude to that of phonemically contrastive [±ATR] pairs in the language, and the tongue advancement in harmonically conditioned [ʌ] does not diminish across multiple iterations.

Additionally, a segment may be harmonically paired in the contrastive inventory, yet still fail to undergo harmony. In Khalkha Mongolian rounding harmony, [e] alternates with [o], and [a] alternates with [ɔ] (Svantesson et al., 2005). High vowels do not undergo harmony, but nonetheless contrast for rounding; both [i] and [u] are present in the phonemic inventory. While [i] and [u] differ along the front/back dimension in addition to rounding, so do harmonically paired [e] and [o] — the contrastive inventory provides no way to distinguish between alternating [e]∼[o] and non-alternating [i]∼[u].

Both Kinande and Khalkha (and other languages like them) are surprising if the content of phonological inventories plays a direct and deterministic role in harmony processes. But we need not throw the insight contributed by a contrast-driven account out with the proverbial bathwater — it's possible to account for both the close relationship between inventories and harmony processes found in many languages *and* the inexactitude of this relationship. If both inventories and phonological processes are shaped by the same markedness factors, the two domains will tend to mirror similar effects but will remain sufficiently functionally independent to allow for divergence.

Against an Asymmetry between Initial and Final Extrametricality

Soohyun Kwon
University of Pennsylvania

Introduction It has been argued that there is an asymmetry between initial and final extrametricality, with initial extrametricality regarded as unnatural or impossible (Kager 2005, Hyde 2011). This study uses an artificial language learning paradigm to examine whether a common stress pattern with final extrametricality is learned better than a rare but attested pattern with initial extrametricality. The common pattern used in this study is that of Latin, in which stress falls on heavy penult, otherwise the antepenult: a trochee with final syllable extrametricality (Hayes 1995). The uncommon pattern is Kashaya, in which stress falls on a heavy second syllable, otherwise on the third: an iamb with initial syllable extrametricality (Buckley 1994). These two patterns are formally equivalent mirror-images. This study examines whether adult speakers learn the Latin stress pattern with final extrametricality more easily than the Kashaya pattern with initial extrametricality.

Methodology Participants were exposed to artificial words for a short period of time and then tested on new test words. The stimulus set consisted of three-, four- and five-syllable nonce words made up of 12 different syllables: four different consonants, [p t k s], combined with three different vowels, [i, a, u]. 54 training words and 18 novel words were constructed. Subjects were eleven native speakers of Seoul Korean aged between 25 and 35 years. Seoul Korean speakers were chosen because that language has no extrametricality, whereas a large subset of English vocabulary follows the Latin pattern. Subjects were randomly assigned to learn either final extrametricality (Latin) or initial extrametricality (Kashaya). The experiment consisted of three parts: 1) In the learning session, subjects listened to nonce words and looked at a picture corresponding to each word. 2) In training session, subjects listened to nonce words and were tested on the words they had just learned. Subjects were presented with two choices of the stimuli, a correct and an incorrect version, and had to choose which version matched the stress pattern. Feedback was provided to improve learnability. 3) Immediately following the training session, subjects were tested on 18 novel words. The new test words repeated the stress pattern they were trained on, so participants demonstrated their understanding of the underlying pattern by scoring well on the novel words.

Results & Discussion The Latin group scored 83.14% correct while the Kashaya group 83.33% correct. An ANOVA showed that there is no significant difference between the Latin and Kashaya groups ($F(1,33)=0.000$, $p=1$) and this indicates that the Latin and Kashaya stress patterns are equivalently learnable patterns. Despite the fact that patterns with right-edge extrametricality are much more widely attested than those with left-edge extrametricality, the results of this experiment suggest that the two patterns are equally ‘cognitively accessible’ to listeners. The findings of this study lend support to Buckley’s (2009) standpoint that the formal system of extrametricality is symmetrical, and there is no penalty to the uncommon rule in synchronic grammar.

Right edge lapses, stress cues, and final lengthening

Anya Lunden
College of William & Mary

There is a lapse asymmetry in stress systems cross-linguistically: Two adjacent, unstressed syllables are often tolerated at the right edge even if they aren't elsewhere. For example, Menominee (Milligan 2005) and Pintupi (Hansen and Hansen 1969) are languages with generally alternating stress, except that a final lapse will occur if the rightmost stress falls on the antepenult. English also tolerates a final lapse (e.g. *América, aspáragus*). The relative acceptability of a final lapse has led to Optimality Theory constraints such as LAPSE-AT-END: [any] lapse must be adjacent to the right edge (Kager 2001) and *EXTENDEDLAPSERIGHT: a maximum of two unstressed syllables separates the rightmost stress from the right edge of a stress domain (Gordon 2002), which both specifically license a word-final lapse. We propose and explore the explanation that stress lapses are tolerated at the right edge because word-final syllables are generally subjected to phonetic final lengthening (first noted at the word-level by Lindblom 1968). A lengthened final syllable, particularly in a language that uses duration as a correlate of stress, may have enough prominence to cause a perceptual alternation in strength between the two unstressed syllables at the right edge. We explore this hypothesis both through a perception study, and through a stress correlate typology.

If final lengthening alone is sufficient to cause a perceptual effect of prominence alternation then subjects of a MFC task charged with identifying "prominence gaps" (where a "gap" is a prominence lapse) should accept alternating sequences of stressed and unstressed syllables that end with an unstressed penult and unstressed-but-lengthened ultima as "fully alternating" (i.e. classify them as cases of "no gap"). Stimuli for this perception experiment were created through a production study in which 22 subjects were asked to read sentences containing nonce words consisting of CV syllables with the stress pattern $\sigma\acute{\sigma}\sigma\sigma$. A significant correlation was found between an increase in duration both with stressed syllables ($p<0.001$) and with final syllables ($p<0.001$). These recordings were used to make stimuli for the perception experiment, which presented 44 listeners with 180 strings consisting of alternating stressed and unstressed syllables and asked whether there is there was a gap or no gap in the prominence alternation. Strings varied between fully alternating (stressed and unstressed syllables), having initial or final gaps (sequences of two unstressed, unlengthened syllables at the beginning or end), and having initial or final stress gaps but with an initial or final syllable at the relevant edge. It was found that syllable strings ending with a stress lapse involving final lengthening were significantly more likely ($p<0.001$) to be identified as having fully alternating prominences than strings with other stress lapses.

If the possibility of final lengthening being perceived as a word-level prominence explains the relative acceptability of word-final stress lapse, we would expect to find duration as a stress correlate in the languages that allow final stress lapse. We have complied a database of 55 languages for which information on both stress and acoustic correlates of stress is available (including impressionistic, acoustically-measured, and perceptually-studied correlates, due to the relatively scarcity of the data). A binomial logistic regression shows a significant correlation between whether a language allows a final lapse and having duration as a cue to stress ($p=0.035$). There is no such correlation for intensity ($p=0.972$) or pitch ($p=0.375$).

We show experimental and typological support for the hypothesis that final lengthening can act as a prominence perceptually. Thus it is not surprising that many languages allow a stress lapse in word-final position, where there is nevertheless alternating prominence.

THE STOCHASTIC ERROR-DRIVEN RANKING MODEL OF CHILD VARIATION

GIORGIO MAGRI (CNRS, UNIVERSITY OF PARIS 8)

■ **The problem** — The child's acquisition of phonology has two macroscopic properties. First, it is *gradual*: the target adult phonology is approached through a path of intermediate stages. Second, it displays a large degree of *variation*: different repair strategies for a certain marked structure coexist at the same time. Various authors have suggested that gradualness can be modeled within *Optimality Theory* (OT) in terms of *error-driven ranking algorithms* (EDRAs) such as Tesar & Smolensky's (1998) EDCD and Boersma's (1997) GLA. These algorithms maintain a current *ranking vector* and loop through the following three steps. They thus define sequences of ranking vectors that can be matched with gradual child acquisition paths (see e.g. Boersma & Levelt 2001).

STEP 1: get a piece of data, i.e. an *elementary ranking condition* (ERC; Prince 2002);
STEP 2: check *OT-compatibility* between this current ERC and the current ranking vector;
STEP 3: *update* the current ranking vector in case OT-compatibility does not hold.

Boersma suggests that a slight modification of this algorithmic scheme allows EDRAs to model child variation as well. The idea is that at step 2 the current ranking values are corrupted by adding independent random noise. And the algorithm checks compatibility of the current ERC with this corrupted ranking vector, rather than with the current one. Because of the additive noise, two constraints with close ranking values can occasionally switch in their relative ranking, yielding variation. This talk addresses the issue of the computational soundness of these *stochastic EDRAs*, thus placing this classical model of child acquisition and variation on solid computational ground.

■ **Main result** — Tesar & Smolensky (1998) prove convergence of the non-stochastic EDRA with a demotion-only update rule at step 3. Magri (2012) extends their convergence result (with comparable error-bounds) to non-stochastic EDRAs that perform both constraint demotion and promotion, as long as the promotion amount is properly *calibrated* (for instance, the promotion amount of the GLA is not calibrated, hampering convergence; Pater 2010). This paper shows that these convergence proofs for non-stochastic EDRAs extend straightforwardly to the corresponding stochastic EDRAs. This extension follows from two crucial implementation details. The first implementation detail is that stochastic EDRAs corrupt the current ranking vector at step 2, but not at step 3: the additive noise is not carried over at the next iteration of the loop. The second implementation detail is that noise is concentrated around zero: either its tail has small probability (say, the noise has a gaussian distribution with null mean) or it is truncated outside of an interval $[-\sigma, \sigma]$ (say, gaussian inside the interval but always zero outside of the interval). In particular, I replicate simulations in Boersma and Levelt (2001) and Curtin and Zuraw (2002) showing that there is no difference between gaussian and truncated-gaussian noise (untruncated additive noise was justified by Boersma in light of speech errors, which fall outside of the scope of this research).

■ **Sketch of the details** — Here, I illustrate the reasoning for the case of the demotion-only update rule, that demotes undominated loser-preferrers by 1 and performs no promotion. The case of calibrated constraint promotion is analogous, although slightly more involved. In the non-stochastic case, Tesar and Smolensky reason as follows. Suppose the data are consistent with the ranking $C_1 \gg C_2 \gg \ldots \gg C_n$. And that initial ranking values are all null, just for concreteness. Then, C_1 is never demoted: in fact, no ERC has an L corresponding to C_1, otherwise C_1 could not be top-ranked. C_2 is demoted at most once: in fact, once it gets to -1, all its L's are dominated by the W's of C_1. And so on. As each constraint can be demoted only a finite, small number of times, the algorithm can overall only make a finite, small number of mistakes before converging. Suppose now we add noise at step 2. Consider first the case where noise is truncated outside of $[-\sigma, \sigma]$. Assume for instance that $\sigma = 1$, just for concreteness. Again, C_1 is never demoted. C_2 can be demoted at most three times: once its ranking value drops to -3, the additive noise (being bound between -1 and 1) is not able to swap C_1 and C_2. And so on. In the end, I show that the worst-case number of mistakes made by this stochastic demotion-only EDRA is just three times larger than the worst-case number of mistakes made by the deterministic one. Finally, this same error-bound holds with high probability in the case where the additive noise is not truncated but gaussian, as in that case the noise will be within the interval $[-\sigma, \sigma]$ with high probability.

Mutual dependence of vowel-zero alternations and palatalisation: evidence from Polish

Grzegorz Michalski
Faculty of English, Adam Mickiewicz University, Poznań
grzegorz@wa.amu.edu.pl

This paper offers plausible evidence for mutual dependence of vowel-zero alternations and lexical palatalisation in Polish. By demonstrating lexical items in which both phenomena are entangled this paper concludes that they are handled by a single component in phonology.

The lexical palatalisation pattern in Polish is most spectacular in the case of coronals. It is illustrated in (1), following Gussmann's *palatalization replacement* patterns ("PR"). The upper row shows plain consonants, the lower row shows their palatalised counterparts.

Vowel-zero alternations are discussed at length in Rubach (1986), Scheer (2004), or Gussmann (2007). In short, a vowel that alternates with zero—such a vowel is often called a *yer*—is phonetically present if not muted by the nucleus of the following syllable; should that syllable contain a stable vowel, the yer is absent phonetically, as shown in (2).

Gussmann (2007) puts yers in phonology proper, and palatalisation in morphophonology (as a separate module), depriving it of any autosegmental causality. Michalski (2009) puts both phenomena back in a single module, restoring autosegmental causality of palatalisation, but failing to combine it with yers in a conclusive manner. The current paper offers necessary evidence. As shown in (2), the co-occurrence applies without exception. 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.

This paper will demonstrate that for reasons of analytic economy vowel-zero alternations and lexical palatalisation must belong in a single component of phonology, as opposed to two.

EXAMPLES:

(1) *PR1* (Gussmann 2007: 128) — fragment

r	w	n	t	d	s	z
|	|	|	|	|	|	|
ʒ	l	ɲ	tɕ	dʑ	ɕ	ʑ

(2)

(2a) *marzec–ϕ* [maʒɛts] 'March'	*marc–a* [martsa] '(id. gen.sg.)'
(2b) *kwiecień–ϕ* [kfʲɛtɕɛɲ] 'April'	*kwietni–a* [kfʲɛtɲa] '(id. gen.sg.)'
(2c) *grudzień–ϕ* [grudʑɛɲ] 'December'	*grudni–a* [grudɲa] '(id. gen.sg.)'
(2d) *orzeł–ϕ* [ɔʒɛw] 'eagle'	*orł–a* [ɔrwa] '(id. gen.sg.)'

REFERENCES: Gussmann, Edmund. 2007. *The Phonology of Polish*. Oxford: Oxford University Press. • Michalski, Grzegorz. 2009. Phonology with interfaces. The morphophonology and post-lexical phonology of English and Polish. [Doctoral dissertation. Adam Mickiewicz University, Poznań]. [LingBuzz/000986]. • Rubach, Jerzy. 1986. Abstract Vowels in Three Dimensional Phonology: the Yers. *The Linguistic Review* 5: 247–280. • Scheer, Tobias. 2004. *A Lateral Theory of Phonology. What is CVCV, and why should it be?* [Volume 1] Berlin: Mouton de Gruyter.

NATIVE AND NON-NATIVE PERCEPTION OF STRESS IN MAPUDUNGUN:

Assessing!structural!maintenance!in!the!phonology!of!an!endangered!language!

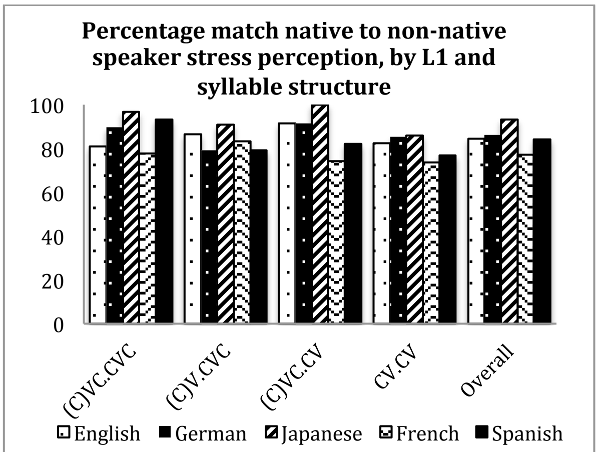
BENJAMIN J. MOLINEAUX - UNIVERSITY OF OXFORD
benjamin.molineaux@ling-phil.ox.ac.uk

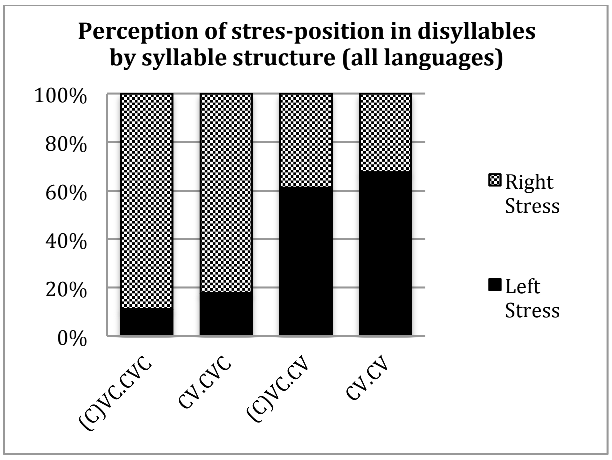
All speakers of Mapudungun (formerly 'Araucanian'), an endangered language of Chile and Argentina, are also fluent in Spanish. While the language has only rhythmic stress, Spanish, the culturally dominant language, has contrastive stress. Identifying the native Mapudungun system, therefore, presents some difficulties: the strong prototype for stress given by Spanish could lead to superimposition of its position and cues on the native system.

In an attempt to disentangle the phonological modules governing each of the languages in the speakers' grammar, we contrasted the percept of stress given by native Mapudungun (and Spanish) speakers with that of native Spanish (monolingual) speakers. As controls, intuitions were also obtained from native speakers of four other languages (English, German, French and Japanese). Strong coincidence between Spanish and Mapudungun might have indicated some features of the prosody of the first being transferred onto the second, but only if such a convergence were distinct from other sampled languages.

We focused on disyllables, which both in our own fieldwork and in the bulk of the literature are considered to alternate the position of stress (cf. [ˈɹu.ka] ~ [ɹu.ˈka] 'house'), while trisyllabic or longer words consistently bear penultimate-mora stress (cf. [ma.ˈwi.θa] 'woodland'; [a.ʧa.ˈwaʎ] 'hen'). Grammars attribute alternation either to lexical stress (Smeets, 2008), or to free alternation (Salas, 2006; Zúñiga, 2007). In our own native speaker data, alternation is constrained to disyllables ending in a vowel, occurring in all such words and hence arguing for free alternation, rather than lexical stress. The question, therefore, is whether this alternation – exceptional as regards the overall system – is native or contact-induced, and furthermore, whether non-native speakers are able to perceive it, making the same categorical distinction between final open and closed syllables.

Subjects (6x Spanish; 2x other languages) heard individual disyllabic Mapudungun nouns with the structures (C)V.CV; (C)V.(C)VC; (C)VC.CV and (C)VC.(C)VC, and were asked, in a forced-decision task, to determine where main stress fell on each word.





Our results show Mapudungun stress perception to be no nearer to Spanish than to any other sampled language. However, non-native speakers were fairly accurate identifying stress irrespective of first language. The very reliability of intuitions on stress shows the distinction between final open and closed syllables to be a real one, and one that can be traced back at least to the 18th century, if we extrapolate the reliability of non-native speaker intuitions on Mapudungun stress to early missionary grammars.

Novel evidence is provided for the robustness of native Mapudungun stress regardless of universal Spanish-bilingualism. Furthermore, the use of non-native speaker intuitions – heretofore considered highly suspect (cf. Werker & Tees, 1984; Dupoux et al. 1997, 2008) – is shown to be methodologically useful in judging the reliability and independence of native speaker judgements within difficult contact and transmission conditions.

L as the only laryngeal-source property in Tokyo Japanese

Kuniya Nasukawa and Phillip Backley
Tohoku Gakuin University and Tohoku Gakuin University
nasukawa@tscc.tohoku-gakuin.ac.jp backley@tscc.tohoku-gakuin.ac.jp

To represent tonal systems, intonation systems and pitch accent systems, it is customary to use two structural units, H(igh) and L(ow): sequences of H and L capture the overall shape of a word's tonal pattern, while combinations of H and L describe the internal structure of individual (contour) tones. H and L function as indivisible properties, and are therefore treated as basic structural units in representations.

In some early feature systems, tonal properties were taken to be segmental in nature (Wang 1967), and like other segmental properties, were expressed using distinctive features. Since then, however, the consensus has been to view H and L as suprasegmental properties residing on independent tonal tiers (Leben 1971). Some tonal and pitch accent systems are analysed as having just active H, with L functioning as a default tone realised in the absence of H, while other systems involve active L with H as the default. Yet others refer to both active H and active L.

In this paper we propose that the pitch accent system of Tokyo Japanese (TJ, hereafter) – in particular, the pitch patterns of simplex native (Yamato Japanese) nouns – be analysed in terms of just a single active L tone, thus challenging existing analyses which refer to a single H tone (Yoshida 1999) or to a HL contour tone (Haraguchi 1991). Furthermore, we demonstrate how L has two distinct functions in the TJ system. Firstly, it operates as a prosodic boundary marker, its role being to signal the left edge of a prosodic word domain. Secondly, L serves as a lexical property which identifies the location of a noun's lexical accent. It is argued that a lexical accent is cued by a fall in pitch, where this fall is the result of assigning a lexical L tone to the accented mora preceded by an unspecified (default H pitch) mora. These two functions of L mainly operate independently of each other, but in certain contexts they are seen to interact in an interesting way.

In addition, L has a third role in the phonology of Japanese, which is to distinguish voiced obstruents (with L) from neutral obstruents (without L). It is now generally agreed that languages with a two-way laryngeal contrast follow one of two typological patterns (Harris 1994; Iverson and Salmons 2006). In aspiration (or H) languages such as English, Korean and Swedish the so-called 'voicing' contrast is cued by different degrees of voicelessness and/or aspiration, rather than by voicing *per se*. But in voicing (or L) languages such as French, Russian and Japanese the laryngeal contrast really is based on a contrast between voiced and voiceless. Thus L is active in Japanese in three ways: as a prosodic marker, as a laryngeal property and as a pitch accent property. The L-based approach developed here not only offers an interesting insight into the nature of the TJ pitch accent system but it also reinforces the view that L dominates the phonology of Japanese as a whole.

When is a Chain Shift Not a Chain Shift? Reassessing Three Troublesome Examples

Nick Neasom, University College London. nicholas.neasom.10@ucl.ac.uk

The problem: There are few definitions of synchronic chain shifting that go beyond a superficial statement that underlying /A/ is realized on the surface as [B], whilst underlying /B/ is simultaneously realized as [C]. The lack of detail in this definition, and the unresolved issue of the motivation for such effects, means that different chain shift theorists have different ideas of what actually constitutes a shift (cf. the divergent scalar accounts of Gnanadesikan (1997) and Mortensen (2006), or Lubowicz's account based on preservation of contrast (2003, 2012)). The widest possible definition is exemplified by Moreton & Smolensky (2002), who explicitly conflate the terms 'chain shifting' and 'counter-feeding', and provide a corpus (maintained and developed online by Moreton) of putative shifts. In the body of their article, Moreton & Smolensky claim that a version of Optimality Theory with Local Conjunction (LC) can reliably model chain shifts, and also makes typological predictions about possible and impossible shifts. Moreton & Smolensky suggest that the three putative shifts below can all be modelled in essentially the same way (2002:313-314)

(1) Catalan: nt# → n# → #

(1) Chemehuevi: V_1V_2# → V_1# → #

(2) Hidatsa: V_1V_2# → V_1# → #

Catalan: The putative shift is created by the interaction of two separate deletion rules; one deleting word-final obstruents, and another deleting word-final nasals (see Mascaró 1976). This can be modelled in Moreton & Smolensky's LC account via the self-conjunction of a MAX constraint. However, this seems to be too powerful a solution, as the rules are not absolute. For example, Mascaró notes that in –Cn# sequences, /n/ is retained, and that /n/-deletion varies in other common contexts, such as after unstressed vowels in disyllables (1976:86). Also, the Catalan example shows that the lack of a conceptual definition of chain shifting leads to irresolvable arguments. Padgett (2002) argues that the Catalan effect is not a true chain shift because the processes are not scalar or unified. This debate is not genuinely theoretical; it is purely a disagreement on what the definition 'chain shift' should cover.

Chemehuevi: Long vowels appear to shorten word-finally, whilst short vowels are completely deleted in the same environment (Press 1979). However, Press herself does not use extrinsic ordering in her account, which specifies that final vowels are first turned voiceless, then deleted. This presupposes a feeding order. If chain shifting and counterfeeding are to be conflated, then the effect in Chemehuevi cannot be a chain shift.

Hidatsa: The imperative morpheme appears to be created by the deletion of a mora (Z. Harris 1942). Whilst Moreton & Smolensky's account can model Harris' example data, the language in general allows word-final consonants (Boyle 2002), meaning that instantiating LC across the grammar would lead to many more incorrect results than correct ones. Moreover, whilst most synchronic chain shifts are in some sense morphologically conditioned, Hidatsa appears to be a morphological process that affects every word in the same way, which can be more accurately modelled by one non-iterative rule or a morphological constraint.

Conclusions: These three effects were chosen because they are discussed by Moreton & Smolensky as processes that can be modelled through the self-conjunction of MAX (2002:313-314). However, it seems clear that grouping them together in this way ignores their separate motivations and complexities. This supports the claim that conflating the terms 'chain shift' and 'counterfeeding' implies a relationship between many different effects that does not appear to exist. This problem is not specific to Moreton & Smolensky's account; indeed, Moreton's online version of the corpus is cited uncritically by, for example, Lubowicz (2011). This poster does not claim to put forward a full account of the properties of synchronic chain shifts. Instead, it suggests that the only way to produce a robust typology of such effects is to study all putative shifts in the context of the languages in which they appear.

Empty nuclei and their phonetic interpretations

Hitomi Onuma
Tohoku Gakuin University
onuma.h6@gmail.com

Phonological empty nuclei were used in analyses of vowel-zero alternations in various languages such as Moroccan Arabic (Kaye (1990)), French (Charette (1991)) and English (Harris (1994)). Analyses employing empty nuclei are typically found in frameworks such as Licensing/Government-based Phonology (Kaye, Lowenstamm and Vergnaud (1990), Kaye (1995)), Element Theory (Harris (1994, 1997, 2005), Harris and Lindsey (2000)) and Strict CV Phonology (Lowenstamm (1996), Scheer (1998, 2004)).

Among the frameworks mentioned above, it is generally assumed that empty nuclei may be phonetically realized as a vowel. It is deemed to be realized as the most unmarked central vowel in a given vocal space: for example, *ə* in English (Kaye (1990), Charette (1991), Harris (2005)), *i* in Cilungu (Bickmore (2007)) and *ɯ* in Japanese (Nasukawa (2005)). The theory, on the other hand, may allow empty nuclei to be phonetically silent. In order to suppress empty nuclei phonetically, Licensing/Government-based Phonology (LGP: Kaye, Lowenstamm and Vergnaud (1990), Kaye (1995)) and Element Theory (ET: Harris (1994, 1997, 2005), Harris and Lindsey (2000)) employ a principle called proper government, which controls phonetic interpretation of empty nuclei: an empty nucleus may be phonetically silent if it is properly governed by its following melodically-filled nucleus (Kaye (1990), Harris (1994)).

This paper argues that English schwa is not a manifestation of an empty nucleus. Given this, we need to consider the phonological representation of a neutral vowel. A claim to respond to this is found in Backley (2009), where English schwa is represented by not an empty nucleus but the presence of a sole [mass] (|A|). Analyzing the alternation between full vowels and schwa in English, we encounter the fact that low and mid vowels — which include feature [mass] (|A|) — tend to alternate with schwa as compared with those high vowels which consist of only [dip] (|I|) or [rump] (|U|). The present discussion also claims that there is no need to refer to proper government (Harris (1994, 1997)) that prescribes the interpretability of empty nuclei. Instead, we can predict the distribution of empty nuclei which may not be interpreted phonetically by referring to dependency relations in prosodic constituents to which most other principles refer in LGP and ET. Eliminating proper government achieves a degree of theoretical restrictiveness and coherence since they are principles which typically refer to precedence relations between (nuclear) positions, rather than to dependency relations.

Learning opacity in a stratal Maximum Entropy framework

Joe Pater and Aleksei Nazarov, UMass Amherst
{pater, anazarov}@linguist.umass.edu

Kiparsky (2000) and Bermúdez-Otero (2003) suggest that connections between morpho-syntactic structure and the ordering of phonological processes in stratal OT facilitate the learning of opaque interactions. In this paper we present experiments with an explicit computationally implemented learning model in which the opaque interaction between Canadian Raising and flapping is better learned if data that show that raising fails to apply at the phrase level are included. These experiments provide support for the hypotheses in Kiparsky (2000) and Bermúdez-Otero (2003) that information about the stratal location of processes aids in the learning of opaque interactions. From a learning theory perspective, these results are of interest in that they show how the failure of a computational learner in a case involving "hidden structure" (Tesar and Smolensky 1998, 2000) may plausibly mimic human learning difficulties in the face of linguistic complexity (as suggested by Boersma 2003), and also because they illustrate the first computational implementation of stratal OT learning.

This study builds on Bermúdez-Otero's (2003) analysis of Canadian Raising, in which raising occurs at the Stem level and flapping at the Phrase level. Bermúdez-Otero's (2003) discussion of learning is cast within the framework of Tesar and Smolensky (1998, 2000). We instead make use of the Maximum Entropy (MaxEnt) formalization of OT learning proposed by Goldwater and Johnson (2003), and methods for UR learning from Eisenstat (2009).

The task for the learner is to find weights (rather than ranks, as in standard OT - this is an inherent property of MaxEnt grammars) for the Stem and Phrase level constraints that will lead to the correct final SRs. This is a "hidden structure" problem because the learner sees only the output of the Phrase level, and not the Stem level. The learner must also pick between underlying /t/ and /d/ for the neutralized flap in cases like [mʌiɾɚ] "mitre" and [saiɾɚ] "cider", by finding appropriate weights for UR constraints (Boersma 2001, Apoussidou 2007). We use a batch learning method, where the objective is to minimize the difference between the distribution in the learning data and distribution produced by the grammar (formalized as K-L divergence). When the learner gets evidence of phrasal non-raising (e.g. [laifɚ] "lie for" *vs*. [lʌifɚ] "lifer"), it is less likely to wind up in a local minimum (implying better learnability) than when it doesn't.

In addition, we compared the performance of the current model on learning of opaque and transparent interactions; opaque interactions are generally assumed to be less easily learnable than transparent ones (see recently Albright & Hayes 2011). Opaque Canadian Raising was much more likely to land in a local minimum (was not nearly as readily learnable) compared to its transparent counterpart. However, ongoing work shows that some other comparisons between opaque and transparent interactions in the current learning model did not show a significant difference in learnability. This brings up further questions of learnability and typology.

Prestessing the unstressable. Lowering the lowerable.
An account of prestressing suffixes in Catalan within Optimal Interleaving

Clàudia Pons-Moll (Universitat de Barcelona)

1. Prestressing suffixes in Catalan. In Catalan, the so called prestressing suffixes (hf PS suffixes) (*i.e. –i*, *–ic*, *–it*, *–id*, *–il*, *–im*, *–fil*, *–fon*, *–graf*, *–ul*, *–metre*) show some intriguing patterns (Mascaró 1976, 1985, 2002) that have not yet been resolved (Mascaró 2003): *a*) unlike the rest of the derivational suffixes, they are unstressed (cf. *carBÒn-ic* 'carbonic' *vs. carboN-ET* 'carbon *dim.*'); *b*) the stress is always placed in the syllable immediately preceding the PS suffix (cf. *cànon* 'canon' ~ *caNÒn-ic* 'canonical'); *c*) when the stem ends in a mid vowel (/e/ or /o/), this vowel is systematically low (*esf*[ɛ́]*r-ic* 'spherical', cf. *esf*[é]*r-a* 'sphera'; *carb*[ɔ́]*n-ic*, cf. *carb*[ó]). This vowel lowering effect is responsible not only for these vocalic alternations in stressed position, which in fact are unique in the Catalan phonology, but also for alternations such as *can*[ɔ́]*n-ic* ~ *càn*[o]*n*, involving words typically considered lexical exceptions with respect to vowel reduction, and *at*[ɔ́]*m-ic* ~ *àt*[u]*m*, involving words with regular vowel reduction. Interestingly enough, vowel lowering just affects PS suffixed words, as denominal inflected forms and other zero derivation forms, sharing the same stem, show: *num*[é]*r-a* 'number PI 3 P'(cf. *num*[ɛ́]*ric* 'numerical'), *introduct*[ó]*r-a* 'introducer *fem. sing.*' (cf. *introduct*[ɔ́]*ri* 'introductory'). These two discrepant patterns with respect to vowel lowering are indentified by Mascaró (2003) as problematic for the models that try to deal with DEE, such as CM (McCarthy 2002). This is why the author precludes a DEE-based analysis of these forms and suggests, following Fabra's observations, that what it is at play here is a constraint against high mid vowels in marked stressed words (such as paroxytones and proparoxytones). **2. New descriptive generalitzations and analytical proposal.** In this paper we show that among these data it is possible to detect some consistencies which allow us to make a clear picture of how the analysis can be. *a*) Prestressing suffixes, unlike the rest of derivational affixes, behave as most inflectional affixes, as far as stress assignment is concerned (*esFEr-a*, *carBÒn-ic vs. carboNET*): both kinds of affixes are invisible to stress; *b*) but they behave differently as for vowel lowering (*carb*[ó]*n-s*, *esf*[é]*r-a*, *num*[é]*r-a* vs. *carb*[ɔ́]*n-ic*, *esf*[ɛ́]*r-ic*, *num*[ɛ́]*ric*). It seems, therefore, that stress assignment crucially precedes inflectional and PS derivation, whereas vowel lowering crucially precedes inflection and crucially follows PS derivation. In other words, vowel lowering is *blocked* in a non-derived environment (**carb*[ɔ́]*ns*), whereas regular stress assignment is *blocked* in a specific derived environment, *i.e.* that implying PS suffixes (**carboNIC*). These facts can be straightforwardly implemented within a model that alows the interaction between phonology and morphology, such as Optimal Interleaving (Wolf 2008). Due to space reasons, we spell out the analysis briefly and simplified (syllabification, for instance, is omitted). 2.1 *Vowel lowering*. The ranking *é, ó >> IDENT(ATR) ensures vowel lowering in cases such as *esfèric* and *carbònic*. Vowel lowering, though, is blocked in the non-DE (*esfera*, *numeri*) due to the activity of the precedence constraint PREC[IDENT(ATR), MAX(Infl)], according to which IDENT(ATR) must be violated before MAX(infl); this constraint rules out the chain *<esfer, esfer-a, esfɛra> and leads the chain <esfer, esfer-a> as the winner). Note how the ranking *é, ó >> IDENT(ATR) is also responsible to account for the selection of low mid vowels in stress position in other situations, such as most proparoxyton words and loanwords (*Am*[ɛ́]*rica*, *f*[ɛ́]*rry*, etc.). 2.2. *Stress assignment*. WTS is the markedness constraint responsible for stress assignment, which in Catalan is located in heavy syllables in a regular basis. Stress assignment occurs before the insertion of inflectional and PS derivational morphs, due to the the activity of the precedence constraints PREC[Max(infl/PS deriv], DEP(stress)), according to which MAX(infl / PS deriv) have to be violated before DEP(stress). This rules out the chains *<carbon, carbon-ic, carboNIC> as well as *<esfer, esfer-a, esfera>, with "premature" morph insertion, in favor of the chains <carbon, carBON, carBOn-ic> and <esfer, esFER, esFER-a>, with stress assignment prior to morph insertion.

Directional harmony and maximal licensing in Maasai

Lindsey Quinn-Wriedt, University of Iowa, Lindsey-Quinn@uiowa.edu

Maasai is an Eastern Nilotic language with about 900,000 speakers in Kenya and Tanzania. Maasai vowels can be divided into two sets – ATR [i, e, o, u] and non-ATR [ɪ, ɛ, ɔ, ʊ, a]. In the absence of /a/, which can block harmony, if there is an ATR vowel in a word, all vowels will be ATR. The purpose of this paper is to present a new OT analysis of Maasai vowel harmony to show that using the theoretical assumptions of Walker (2011), it is possible to account for the very complex harmony system in Maasai without resorting to more complicated alternatives seen in analyses like Baković (2000). (Data collected in the Arusha region of Tanzania).

1.	a. /ɪ-put-ɪʃɔ/	[iputiʃo]	2nd pres intransitive "pluck"
	b. /ɪ-nʊk-iʃe/	[inukiʃe]	2nd past intransitive "cover"
	c. /nɛ-ma-ʃol/	[nɛmaʃol]	1st sg negative future "melt"
	d. /ɪ-puk-a/	[impuko]	2nd sg past "flee"

In (1a) the ATR root causes the affixes to harmonize, and in (1b) the ATR suffix causes the non-ATR root and prefix to harmonize. In (1c) the opaque /a/ blocks the leftward harmony, but in (1d) it harmonizes to [o] due to the preceding ATR vowel. Both Levergood (1984) and Baković (2001) assume the cycle to account for harmony with ATR spreading from the root outward, and Baković's OT account also relies on an anti-cyclic harmony process to account for an ATR suffix that causes a root to become ATR if no /a/ intervenes between the suffix and root.

Walker (2011) proposes a maximal licensing constraint which causes unbounded harmony by licensing only vowels that coincide with the dominant feature. She suggests that seemingly bidirectional harmony could be the result of the two unidirectional maximal licensing constraints. An analysis of Maasai supports this suggestion; the low vowel in Maasai demonstrates the necessity for two unidirectional harmony constraints. By ranking $\text{License}_{\text{RIGHT}}$ above ID labial and $\text{License}_{\text{LEFT}}$, the low vowel harmonizes when *preceded* by an ATR vowel, but not when *followed* by an ATR vowel. $\text{License}_{\text{LEFT}}$ penalizes every non-ATR vowel to the left of an ATR vowel, while $\text{License}_{\text{RIGHT}}$ penalizes every non-ATR vowel to the right of an ATR vowel. To prevent an input ATR vowel from being non-ATR in the output, the ID IO ATR constraint is split into an input to output constraint (I→O ATR) which is ranked above the output to input constraint (O→I ATR). Maasai also necessitates a high-ranked markedness constraint against the ATR counterpart to /a/, which never surfaces in Maasai: *ə. Finally, either ID labial, or ID low must be ranked between $\text{License}_{\text{LEFT}}$ and $\text{License}_{\text{RIGHT}}$.

Antiharmony, transparency, truncation

Péter Rebrus, Research Institute for Linguistics, Hungarian Academy of Sciences, rebrus@nytud.hu
Péter Szigetvári, Eötvös Loránd University, Budapest, szigetvari@elte.hu

Backness harmony with the neutral behaviour of *i*, *í* [iː] and *é* [eː] are the most often analysed aspects of Hungarian phonology. We discuss transparency (TP) and antiharmony (AH). **TP** is observed when a back+neutral mixed stem takes a back suffix (BN+B): e.g., *forint-nak* 'Forint-DAT', while the non-mixed neutral stems take a front suffix (NN+F): *kilincs-nek* 'doorhandle-DAT'. This behaviour of neutral vowels is largely compulsory and productive. On the contrary, **AH** is restricted to a specific stem-class: monosyllabic stems with a neutral vowel that take a back suffix alternant (N+B): *hív-hat* 'call-MOD'. ("Normal" neutral stems are suffixed by a front alternant (N+F): *csíp-het* 'pinch-MOD'.)

Suffixed forms also show TP: a back stem followed by a neutral suffix obligatorily takes the back alternant (B+N+B): *nap-i-nak* 'day-ADJ-DAT', *ad-ni-a* 'give-INF-3SG'. The two effects can be combined if an AH stem is suffixed by a neutral suffix. In this case the suffix will also be back after the AH stem: N(+N)+B: *hid(-i)-ak* 'bridge(-ADJ)-PL'. If the stem is harmonic front, the suffixed form will be front too: N(+N)+F: *viz(-i)-ek* 'water(-ADJ)-PL'. Crucially, these phenomena are independent of the morphological status of the morphemes: the suffixes can be deverbal or denominal and inflectional or derivational. This is summarized below:

(1) *Harmonic types of neutral forms*

	stem	only front suffix	front or back suffix	only back suffix
a.	monomorphemic	F	**N**	B
		FN, NN		BN
b.	suffixed	F+N	**N+N**	B+N

Thus, stems of the type X+N seem to show the same pattern as their absolute stems do: *a neutral suffixed form is harmonically identical to the stem*. This hypothesis of harmony preservation will be tested in a subsystem of Hungarian morphophonology: we will examine what happens if **truncation** interacts with the harmonic patterns. There are two truncating suffixes relevant here, both of them induce vowel–zero alternation in the stem and contain neutral vowels. The verb forming suffix *-ít* shows the harmony preserving effect mentioned above, i.e., if the stem contains a neutral+back vowel sequence its truncated suffixed forms will also do so (*N***B** and *N*+N+**B**): *bén**a*** 'paralyzed' and *bén-ít-h**a**t* 'id.-VERB-MOD', and the same is true for front vowels (*N***F** and *N*+N+**F**): *bék**e*** 'peace' and *bék-ít-h**e**t* 'id.-VERB-MOD'. The diminutive (DIM) suffix *-i* (and its variants *-ci, -csi, -si* etc.), however, show a different pattern. *Neutral-vowelled DIM forms are always harmonically front regardless of the original harmonic class* of the truncated stem: *Tib**o**r, Év**a*** names and *Tib-i-n**e**k, Év-i-n**e**k* 'id-DIM-DAT'. It is important to note that the source of front harmonicity cannot be the DIM suffix, because the suffix vowel shows TP behaviour: *Sára* name and *Sár-i-n**a**k* 'id-DIM-DAT'. That is, the vowel of the DIM suffix is *TP for back vowels and not TP for the neutral vowels* of AH stems. The difference of these two suffixes in their harmonic behaviour is the same as what we find in (1): *-ít* suffixation is similar to other (non-DIM) suffixation, (1b), and forms with DIM *-i* are similar to monomorphemic forms, (1a). Harmony preservation can be analysed by assuming paradigmatic uniformity constraints between the stem and the suffixed form, hence violation of preservation is explained by a special status of DIMs.

A harmony-like process in Asia Minor Greek: Phonology realizes morphology

Anthi Revithiadou	Vassilios Spyropoulos	Giorgos Markopoulos
(AUTh)	(University of Athens)	(AUTh)
revith@lit.auth.gr	vspyrop@phil.uoa.gr	gmarkop@lit.auth.gr

Asia Minor Greek dialects have been affected by the long-term language contact with Turkish in a way that they exhibit interference at all grammatical levels (Dawkins 1916; Janse 2002, 2009; see also Thomason & Kaufman 1988; Johanson 2002). An immediate result of language contact is the parallel existence of both fusional (Greek pattern) and agglutinative (Turkish pattern) morphology in the nominal system (1-2) (Dawkins 1916; Janse 2004; Spyropoulos & Kakarikos 2011; Karatsareas 2011), especially in the most turkicized varieties (e.g. Ulaghatsh and Fertek) of the Cappadocian (CGr) branch. In this paper, we argue that the transition from fusion to agglutination finds a phonological expression in terms of a harmony-like process which developed in order to reflect the merge between the stem and the 'old' inflection.

Ulaghatsh		(1) *Fusional paradigm in -os*	(2) *Agglutinative paradigm*
SINGULAR	NOM	/xeríf-os/ → *xerífos* 'man'	/líkos-∅/ → *líkos* 'wolf'
	GEN	/xeríf-jú/ → *xerifjú*	/líkos-jú/ → *líkozju*
	ACC	/xeríf-o/ → *xerífo*	/líkos-∅/ → *líkos*
PLURAL	NOM/ACC	/xeríf-ja/ → *xerífja*	/líkos-ja-∅/ → *líkozja*
	GEN	-	/líkos-ja-jú/ → *líkozjajú*

The agglutinative paradigm clearly shows that the 'old' inflection was re-analyzed as part of the stem, e.g., lik$_{[base]}$-os$_{[infl]}$ → likos$_{[base]}$, a process that was assisted by (a) the various syncretism rules between nominative and accusative case, (b) the *Differential Object Marking* that these dialects exhibit (Janse 2004, Spyropoulos & Tiliopoulou 2006), and (c) the fact that -∅ is defined as the general default formative for case and the grammatical categories of number and case are marked separately, e.g. likos-∅, likos-ja$_{[pl]}$-∅, **líkos**-ja$_{[pl]}$-**jú**$_{[gen]}$. Interestingly, the *merge* of the base and the 'old' inflection is reflected at the phonological level by means of a vowel process which looks superficially like the Turkish vowel harmony (Revithiadou et al. 2006) but which in fact is dramatically different from it (see also Van Oostendorp 2005): First, the spreading of [back]/[round] features shows sensitivity to stress since only unstressed vowels can be triggers. Second, it has a binary, right-to-left domain of application and, third, it is strictly restricted to the nom/acc singular forms of the fusional paradigm, e.g. **ðáskol-u* 'teacher-GEN', and it has lexical exceptions.

(3) a. /petsét-a/ petsáta 'napkin' Sil, K185
b. /ðáskal-os/ ðáskolos 'teacher' Far, An48:20
c. /ánem-os/ ánomos 'unlawful' Ul, K13,§3
d. /koskin-o/ koskuno 'sieve' Sil, Ko31

(4) a. ð á s k a l o s [+rd] b. p e t s é t a [+bk]

We argue that the spreading of the [back]/[round] features from the inflection to the stem is a form of *conflation* (à la Postma, Hermans & Van Oostendorp 2006): the inflection 'merges' with the stem at the morphological level and this is mirrored at the phonological level by means of sharing the same feature.

Speech Recognition Informed by Distinctive Feature Theory: the Featurally Underspecified Lexicon Model and its Implications.

Philip J. Roberts (University of Oxford) and Henning Reetz (Goethe-Universität Frankfurt)
philip.roberts@ling-phil.ox.ac.uk, reetz@em.uni-frankfurt.de

We present a speech recognition engine that implements the Featurally Underspecified Lexicon calculus (FUL: Lahiri and Reetz (2002, 2010). The FUL model defines an inventory of privative phonological features that is necessary and sufficient to describe contrasts between phonemes in any language in the world. It is an explicit goal of FUL that features should be defined both articulatorily and acoustically with enough rigor that it is possible for a computer program to identify where they occur in the speech signal. The model also defines conditions for comparing feature bundles recovered from the signal with segments defined in the lexicon: a bundle of simultaneous features recovered from the signal will evaluate against a segment in the lexicon with one of three possible responses:

Response	Definition	Examples
MATCH	the feature is present in both the signal and the lexicon	[LAB] from signal [p] in *pin* compared with /p/ in lexical entry for *pin*
MISMATCH	the features in the signal violate one or more mismatch conditions defined by the theory	[LAB] from signal [p] in *pin* compared with /k/ in lexical entry for *kin*
NOMISMATCH	the feature in the signal is not part of the segment in the lexicon but no mismatch condition is violated	[LAB] from signal [p] in *pin* compared with /t/ in lexical entry for *tin* [COR] from signal [t] in *tin* compared with /t/ in lexical entry for *tin* (see below)

Provided that no MISMATCH condition is provoked, the score for a bundle of signal features as compared with the lexicon is computed according to the following formula:

$$\text{SCORE} = \frac{(\text{NR. OF MATCHING FEATURES})^2}{\text{NR. OF FEATURES FROM SIGNAL} \times \text{NR. OF FEATURES IN THE LEXICON}}$$

Even when features are recovered from the signal with 100% accuracy, it is still possible for a NOMISMATCH condition to be raised, because the lexicon is underspecified for features such as [CORONAL] and [PLOSIVE]. For example, if the feature [CORONAL] is parsed out of the signal for the sound [t], as in the *tin* example above, it will NOMISMATCH with /t/ in the lexicon, because the lexicon /t/ is not explicitly specified for [CORONAL] or [PLOSIVE]:

lexicon [t]: [CONS, OBS]
signal [t]: [CONS, OBS, PLOS, COR]

Score: $\frac{2^2}{4\times 2} = \frac{4}{8} = 0.5$

This matching mechanism has been shown to account for asymmetries as they are observed in natural speech, such as that [CORONAL] assimilates to [LABIAL] but not the other way around (see Cornell et al. 2011). The engine computes distances to neighboring words according to this coherence measure to simulate co-activation in the lexicon (see Lahiri and Reetz 2002: 641). At present, the engine uses the word-form lists from the CELEX lexical database as its lexicon, but it is designed to be extensible to cover any lexicon from any language, provided that FUL feature definitions for the segment inventory are defined. We will demonstrate the operation of the engine in real time in English and German.

Kyrgyz Vowel Harmony

Dariia Safina, Boğaziçi University, dariyasafina@gmail.com

Vowel harmony (VH) has been of interest to phonologists for a long time. However, trying to explain VH in terms of Licensing Constraints (LCs) using the Government Phonology (GP) framework is a relatively new attempt. Charette and Göksel (1996) tried to come up with LCs that would both give the vowel inventory of Turkish and explain its VH. According to them spreading of an element is a "giving of permission" to itself to appear in the following nucleus, in other words a licensing of an element in its governing nucleus. They propose three LCs for Turkish: 1)Operators must be licensed, 2)A is not a licenser and 3)U must be a head. They assume the same LC to be for Yakut, Kazak and Kyrgyz. If LCs are meant to capture both vowel inventory and VH, we would expect these languages to be identical for both. However, they differ from Turkish in U-harmony. In Kyrgyz, U spreads to the operator position from complex expressions but not from simplex ones. They attribute this fact to the "switching constraint", such that U can switch or "change its place" with A to become a head of the governee expression in the presence of I or A in the governor (preceding) nuclei. Without switching, U harmony would violate the LC on U, as it is able to spread from complex expressions to operator. However, there is no reason why Kyrgyz should exhibit switching while Turkish does not. In this paper (couched in GP) I propose different LCs for Kyrgyz that give the Kyrgyz vowel inventory and its VH, but avoid the need for a switching.

Kyrgyz exhibit I and U harmonies. Some suffix vowels are empty, such as the accusative case marker -n({ }) or the questioning copula b({ }), while others are lexically headed such as the plural suffix -l({ }A)r or dative -g({ }A). In the first type of suffix, I and U harmony operate freely, while for the second type U-harmony is restricted: U is not able to spread to the headed suffixes from simplex expressions, but it spreads freely from complex ones (1):

1.

Noun	Phonol. rep.	meaning	Acc	Phonol. rep.	Plural	Phonol. rep.
a) kir	k({ } I)r	"mud"	kir-di	k({ } I)r-d({ } I)	kir-ler	k({ } I)r- l({ I } A)r
b) nur	n({ } U)r	"ray"	nur-du	n({ } U)r-d({ } U)	nur-lar	n({ } U)r-l({ } A)r
c) bor	b({U} A)r	"chalk"	bor-du	b({U}A)r-d({ } U)	bor-lor	b({U}A)r-l({U} A)r
d) bel	b({I}A)l	"loin"	bel-di	b({I}A)l- d({ }I)	bel-der	b({I}A)l-d({I}A)r
e) kyn	k({U}I)n	"sun"	kyn-dy	k({U}I)n-d({U}I)	kyn-dœr	k({U}I)n-d({U I}A)r

I propose that the LC for Kyrgyz are 1)All operators must be licensed, 2)A cannot be licensed and 3)U as a head cannot license operators. These constraints give the following vowel inventory:

2. Phonet.rep.	Expression	Phonet.rep.	Expression	Phonet.rep.	Expression	Phonet.rep.	Expression
ɨ	({ })	A	({ } A)	U	({ } U)	I	({ } I)
O	({U } A)	e	({ I } A)	Y	({ U } I)	Œ	({I U} A)

The proposed LCs also capture Kyrgyz VH. As there is no LC on I, I spreads whenever it is present as showed in 1 a, d and e. The constraint on U, that U from the head position cannot license operators, explains why U is able to spread from all expressions into empty suffixes and just from complex ones into lexically headed suffixes. The accusative form of *bor* is *bor-du* because the suffixal vowel of the accusative is empty and nothing prevents U from spreading from operator to head position; and the plural is *bor-lor* as there is no prohibition against spreading of U from operator. The accusative form of *nur* is also *nur-du* as U is able to spread from head to head position. However the plural form of *nur* is *nur-lar* as the plural suffix is headed by A and U cannot spread from head to operator position.

It is clear that the proposed LC fully account for VH without switching and also give vowel inventory of Kyrgyz. The different representation of Kyrgyz and Turkish vowels suggests that they differ in quality and this fact is supported by spectrograms. Based on this fact and the avoiding of switching I propose that my analysis offers a more credible account of Kyrgyz VH.

Predicting a future phonology

James M Scobbie and Jane Stuart-Smith

Phonological theories make predictions on the basis of formal relations, structural complexity, and, in more phonetically-grounded approaches, appeals to functional tendencies and phonetic naturalness. Predictions from phonology help explain patterns in acquisition, perception, production and processing, as well as the more traditionally phonological domains of diachrony, cross-linguistic typology, inventory structure within a single language, and patterns of alternation. Phonology surely ought also to make clear predictions about possible future diachronic change in any language.

One clear way in which this might be done, in any framework which accepts that phonological inventories and structures are phonetically grounded, is by looking at patterns of phonetic variation within a currently normative phonological analyses, whether these variants arise from stylistic, sociolinguistic, contextual, allophonic or random factors. Predictions arise from tension between the phonetic distribution of contrasts and the phonetically-inspired labels for the contrastive elements.

In this talk we will review the standard phonological structural analyses of a sample language, Scottish English. We will review recent phonetic evidence relating to the realisations of a number of vowels and consonants, highlighting the tension between these findings and the traditional featural, typological segmental inventory. This leads us to speculate on possible diachronic phonological changes, making reasoned predictions about how Scottish English phonology might change.

In the vowel system, we consider emergent contrasts due to derhoticisation, which could give rise to new vowels, new distributions of existing vowels, and changes to the established patterns of minimal pairs. For example, loss of /r/ is leading phonetically to a vowel apparently homophonous with STRUT appearing in short open syllables. This vowel has very similar formants to START. START, losing its /r/, is long. If these patterns become phonologised, then STRUT and START would both appear in open syllables, an innovation in this variety, and be distinguished by phonological length. The traditional picture in which START and TRAP are allophones will be broken. We also consider the place in the system of the GOOSE&FOOT and GOAT vowels. The Scottish Vowel Length Rule also may give rise to duration-based contrasts, given existing quasi-phonemic contrasts in high vowels (e.g. brood vs. brewed), complex phonotactics and lexeme-specific specifications of length.

We will also consider consonants, discussing the existence of ejective stops and pre-aspirated fricatives in Scottish English, and their phonological interpretation.

In our discussion, we will note that these type of predictions are what substance-rich or exemplar-based approaches to phonology naturally provide. This is particularly so when phonological inventories may be fuzzy and non-deterministic, and reflect speaker knowledge of multiple systems as part of sociolinguistic competence. Standard phonological theories, on the other hand, especially substance-free ones, tend to track phonologisation retrospectively, relying on patterns of contrast, alternation, diachronic merger and synchronic neutralisation from a safe historical distance. We will argue, however, that they cannot (or more charitably are not used to) predict the next stage of diachronic development. We argue that empirically-based predictions of future developments are as important a part of any scientifically-oriented theory as predictions based on formal symmetry and structural simplicity, and that predicting the future should be a more common phonological activity.

The lives of Latin laterals: reconstructing a three-way surface specification

Ranjan Sen, University of Sheffield (ranjan.sen@sheffield.ac.uk)

The diachronic behaviour of a sound and its neighbours can allow us to reconstruct the segment's variant phonetic realisations in different structural and linear environments, which in turn may permit us to identify categorically distinct variants of the segment in the pre-change synchronic phonology. A careful amalgamation of wide-ranging evidence from Latin permits us to discern three phonological specifications of Latin /l/ at an early period: (1) dark in codas, (2) clear in geminates, and (3) underspecified tongue body position in onsets. The former two are recognised by traditional Latin grammars (e.g. Meiser 1998: 52), but there is ambiguity and disagreement in accounts of (3). However, evidence (below) clearly indicates consistent darkness in codas and clearness in geminates, and gradient darkness conditioned by the environment in the underspecified variant, as predicted by Keating (1988). This allows us to establish a ternary contrast in backness (+ – Ø), a somewhat elusive pattern sought out by proponents of equipollent features (Kim 2002, Vaux 2010), and usually illustrated by voicing in Turkish (Inkelas & Orgun 1995).

Evidence comes from Roman grammarians, and the colouring of the preceding V to /o, u/ before dark /l/. Pliny reports dark /l/ (described as *ple:nus* 'full') in syllable-final position, clear /l/ (*exi:lis* 'thin') in geminates, and non-dark /l/ (*medius* 'ambiguous') elsewhere. Coda /l/ caused backing of a preceding vowel to /u/ (**ensalsos* > *i:nsulsus* 'dull'). Pliny's *medius* variety concurs with the colouring evidence that /l/ was contextually darkened in onsets, conditioned by the following vowel: a following /a o u/ darkened onset /l/, resulting in backing to /u/ (**konseluerunt* > *co:nsulue:runt* 'they took counsel'). However, this onset /l/ was not as dark as coda /l/, as shown by the backing only to /o/ and not /u/ in stressed initial syllables (**wel.tes* > *vul.tis* 'you want' vs. **we.lo:* > *vo.lo:* 'I want'). Traditional grammars disagree as to which variant appeared before /e/, but colouring indicates that /l/ was relatively dark in this environment (**ad-ale:sko:* > *adole:sco:* 'I grow up'). However, this /l/ was not as dark as coda /l/, or the /l/ preceding /a o u/, as backing word-internally was only to /o/ and not /u/ (cf. *adultus* 'adult' from the same root). Finally, onset /l/ before /i/ behaved identically to /ll/ in any context (no colouring), suggesting that the former was contextually palatalised, but the latter clear by specification. This is corroborated by the degemination of /V:ll/ > /V:l/ *only* before a following /i/: *mi:lia* 'thousands' beside *mi:lle* 'thousand'.

Coda /l/ in Latin was therefore assigned a phonological specification for darkness, which can be interpreted as a velarising dorsal gesture (Sproat & Fujimura 1993), or a [+back] feature. Geminate /ll/ was specified for a palatalising dorsal gesture, or [-back] feature, and onset /l/ was underspecified for its dorsal gesture or backness.

<table>
<tr><td>Pliny's term</td><td>exi:lis</td><td colspan="6">medius</td><td>ple:nus</td></tr>
<tr><td>Categorical specification</td><td>[-back]</td><td colspan="6">Underspecified for backness</td><td>[+back]</td></tr>
<tr><td>Gradient phonetics</td><td colspan="2">Clear/Palatalised</td><td colspan="2">Dark</td><td colspan="3">Darker</td><td>Darkest/ Velarised</td></tr>
<tr><td></td><td>Geminate [ll^j]</td><td>[l^{j}i(:)]</td><td>[le:]</td><td>[le]</td><td>[la(:)]</td><td>[lo(:)]</td><td>[lu(:)]</td><td>Coda [l^ɣ]</td></tr>
</table>

-(i)licious: A Case of Product-Oriented Allomorphy in English

Brian W. Smith (bwsmith@linguist.umass.edu)
University of Massachusetts Amherst

There are two ways to state many phonological generalizations: in terms of the output (product-oriented); or in terms of the input (source-oriented). The logic of OT-based models rests on the assumption that generalizations are product-oriented. In artificial grammar tasks, speakers are better at learning product-oriented generalizations than source-oriented generalizations (Becker & Fainleib 2009, Kapatsinki 2009, 2011); however, no unambiguous cases of product-oriented generalization in natural language have yet been described. This paper presents experimental evidence for such a case in English, in which the choice between two allomorphs is dependent on features that are present in the output, but not the input.

The relevant case is the distribution of suffixes like *-teria* and *-eteria* (Siegel 1974). The suffix *-teria* occurs with final-unstressed roots, as in *candy-teria,* while *-eteria* occurs with final-stressed roots, as in *shoe-eteria.* There are about thirteen pairs of English suffixes that follow this pattern, but I'll focus on *-licious/-ilicious* here. The correlation between suffix and stress context can be stated as a product-oriented generalization (1) or a source-oriented generalization (2).

1. Use -ilicious with roots that have the surface structure [...σ́]
2. Use -ilicious with roots that have the underlying structure /...σ́/

The place where (1) and (2) make different predictions is the interaction of allomorph selection and the rhythm rule, a phonological rule that is able to remove an underlying stress, as in *thirteen men*: /θɪ̀ɹtín mɛ́n/ → [θɪ́ɹtin mɛ́n].

Product. If English allomorphy is product-oriented, as in (1), then allomorph selection will consider the product of the rhythm rule. For a word in which the rule can apply, like *hàrpóon*, a speaker has two options. She can either apply the rhythm rule and choose *-licious,* creating *hárpoon-lìcious*, or she can forgo the rhythm rule and choose *-ilicious,* creating *hàrpóon-ilìcious*. For a word in which the rhythm rule cannot apply, like *políce*, only one option is available: *políce-ilìcious.* The product-oriented account predicts that *-licious* will be more likely in *hàrpóon*-type words, and *-ilicious* will be more likely in *políce*-type words.

Source. If English allomorphy is source-oriented, as in (2), then all words with underlying final stress will prefer *-ilicious* and *-licious* to the same degree, regardless of whether they can undergo the rhythm rule.

Experiment. In a forced choice task, speakers chose between *-licious* and *-ilicious* variants of the same word, e.g. *police-ilicious* and *police-licious.* Words belonged to one of two experimental conditions: *hàrpóon*-type words, in which the rhythm rule can apply; and *políce*-type words, in which it cannot. Conditions were balanced for lexical frequency, final consonant, and number of syllables. The results of the experiment support the product-oriented generalization. Speakers are 10% more likely to choose the suffix *-ilicious* with *políce*-type words than *hàrpóon*-type words. In a logistic regression, this effect is significant ($p<0.01$).

This paper presents a new case of product-oriented generalization in English. The finding supports the common product-oriented account of allomorphy in OT, in which the choice between allomorphs is determined by markedness constraints (e.g., Mester 1994, Mascaró 1996, Kager 1996, Wolf 2008).

Lapsed Derivations: Ternary Stress in Harmonic Serialism

Francesc Torres-Tamarit, Meertens Institute   Peter Jurgec, Leiden University
xico.torres-tamarit@meertens.knaw.nl   peter@jurgec.net

This paper deals with ternary stress in Harmonic Serialism (HS). We take the constraints that have been used to model ternary stress in parallel Optimality Theory (POT) and look at their predictions in HS. All the typological claims have been tested using OT-Help 2.0 (Staubs *et al.* 2009). The comparison reveals that standard POT rhythm constraints adduced for ternary stress —*LAPSE (Elenbaas & Kager 1999) and PARSE-2 (Ishii 1996)—, which are independently motivated, fail to produce iterative ternary stress and make pathological predictions in HS. The pathological predictions arise because incremental optimization of metrical structure in HS, on the one hand, and rhythm constraints, on the other hand, turn to be irreconcilable.

Ternary stress presents a unique challenge to constraint-based metrical stress theories: how to model stress that falls on every third syllable without using ternary-specific tools such as ternary feet (Halle & Vergnaud 1987, Levin 1988, Dresher & Lahiri 1991, Rice 1992) or constraints that emulate the ruled-based Hayesian weak local parsing, *i.e.*, *FTFT (Kager 1994). Along this line of reasoning, Elenbaas & Kager (1999) argue in favor of using the independently-motivated grid-based rhythm constraint *LAPSE defined in (1) to model ternary stress in POT (for other approaches, see Kager 2007, Houghton 2008 and Rice 2011).

(1) *LAPSE (Elenbaas & Kager 1999)
Every weak beat must be adjacent to a strong beat or the word edge. (Sequences of 3 unstressed syllables are prohibited.)

As a matter of illustration, this short abstract only focuses on the rhythm constraint *LAPSE when applied to the language that exhibits the most straightforward ternary pattern —Cayuvava (Key 1961, 1967). Cayuvava has stress on every third syllable counting from the right edge of the word, except for disyllabic words, which show initial stress. The pattern is standardly analyzed as assigning right-to-left trochees under weak local parsing with final extrametricality (Hayes 1995). Elenbaas & Kager (1999) interpret ternarity as the result of avoiding lapses while at the same time the number of feet is kept at the minimum. *LAPSE enforces bounded systems, not ternary systems. Binarity or ternarity is the result of ranking PARSE-σ above or below ALLFT-X constraints, respectively. For Cayuvava, ternarity is obtained with the constraint ranking *LAPSE$\gg$ALLFT-L$\gg$ALLFT-R$\gg$PARSE-σ.

In HS, footing proceeds sequentially, with each step being locally optimized (Pruitt 2010). Given that Cayuvava shows right-to-left footing, ALLFT-R must outrank ALLFT-L. For instance, in a 6-syllable word, the ALLFT-R$\gg$ALLFT-L ranking at step 1 evaluates the parsing $\sigma\sigma\sigma(\acute{\sigma}\sigma)\sigma$ as more harmonic than $\sigma\sigma(\acute{\sigma}\sigma)\sigma\sigma$. These two competitors tie wrt *LAPSE. In both candidates, *LAPSE is violated once because there is one sequence of 3 unstressed syllables. But *LAPSE, if top-ranked, discards the perfectly right-aligned candidate $\sigma\sigma\sigma\sigma(\acute{\sigma}\sigma)$ showing 2 sequences of 3 unstressed syllables. The crucial point is that at step 2, no matter the ranking of *LAPSE, the candidate showing adjacent feet $\sigma(\acute{\sigma}\sigma)(\acute{\sigma}\sigma)\sigma$ is more optimal than the desired candidate showing ternary stress $(\acute{\sigma}\sigma)\sigma(\acute{\sigma}\sigma)\sigma$ because of the ALLFT-R$\gg$ALLFT-L ranking. Notice that both candidates satisfy *LAPSE, which thus fails to predict ternary stress in HS. This problem vanishes if *LAPSE is replaced by ternary-specific *FTFT, which explicitly prohibits adjacent feet, and as such is not independently-motivated. *FTFT can only be violated if a form contains two feet, thus it is always satisfied at step 1. The position of the first foot is hence entirely up to ALLFT-X constraints and at step 2 *FTFT causes one syllable to be skipped.

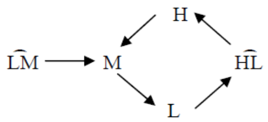
This paper shows that ternary stress in HS can only be derived using constraints that make reference to constituency, *FTFT, but not to rhythm, *i.e.*, the distribution of peaks and troughs. This reveals a fundamental difference between HS and POT: only global optimization is compatible with rhythm constraints. Trying to derive ternary stress from independently-motivated constraints in HS thus seems a chimera, showing that ternary stress is best modeled as a global effect of feet minimisation in bounded systems.

Tone Sandhi in Loanwords in Taiwanese Southern Min

Jung-yueh Tu[1] and Stuart Davis[2]
[1]National Taiwan Normal University, [2]Indiana University
royaldu@gmail.com, davis@indiana.edu

This study investigates tone sandhi in loanwords in Taiwanese Southern Min (TSM), specifically, tone sandhi as it occurs in normal phrasal contexts. We know of no previous study on this topic. Unlike native words in TSM with the one-morpheme-per-syllable tendency, loanwords (mainly from Japanese) can consist of polysyllabic monomorphemic words. One may wonder if tone sandhi occurs in loanwords as they do in a phrase, and if so, how tone sandhi rules apply to the loanwords. TSM has seven tones, including five non-checked tones (H, M, L, L͡M, H͡L) on sonorant-ending syllables and two checked tones ($\underline{\text{H}}$, $\underline{\text{M}}$) on obstruent ending syllables. Tone sandhi in TSM describes a pattern of tone alternations conditioned by the boundaries of prosodic phrase built on the syntactic constituents like NP and VP (Tsay, Myers, & Chen, 1999). The tone sandhi rules for non-checked tones and checked tone are given in (1) and (2). On the other hand, Japanese has a pitch accent system, which can be superimposed on polysyllabic words to make phonemic contrasts. Japanese loanwords in TSM include polysyllabic monomorphemic words, such as /*su.ɕiʔ* / H$\underline{\text{M}}$ 'sushi' and /o.tɔ.baiʔ/ MHH͡L 'motorcycle' and have a tone pattern similar to the Japanese default accent pattern (favoring a right edge pitch fall). In our study using native speaker consultants we requested the use of loanwords embedded in a sentence, where the loan-words occur both in sandhi (phrase-internal) and non-sandhi positions (phrase-final), as in (3). The results show that in Japanese loanwords, non-final syllables in sandhi contexts do not under-go tone sandhi while the final syllables of these words generally undergo tone sandhi when they are in sandhi contexts, as in (4) (as seen by the first instance of the word 'sushi' where the tone is in bold). This is the first study showing this. That non-final syllables do not change in loanwords is consistent with a view of TSM tone sandhi as syntactically determined. We relate our findings on loanword tone sandhi to those very rare cases of native polysyllabic monomorphemes which show a similar pattern; for example /p^h*u.to*/ L͡M.L͡M 'grape' has only the second syllable undergoing tone sandhi in the phrase /p^h*u.to tsiu*/ L͡M.M. H͡L 'grape liquor.' These data make clear that TSM tone sandhi only occurs over a morpheme boundary and not within morphemes.

(1) Tone sandhi rules for non-checked tones



(2) Tone sandhi rules for checked tones
a. $\underline{\text{H}}$→ $\underline{\text{M}}$ b. $\underline{\text{M}}$→$\underline{\text{H}}$

(3) (# indicates a syntactic boundary, citation tone is the non-sandhi tone)

	li	be	k^hi	*su.ɕiʔ*	tiam		be	*su.ɕiʔ*	
	you	want	go	sushi	store		buy	sushi	
Citation tone	H͡L	$\underline{\text{M}}$	L	**H.$\underline{\text{M}}$**	L	#	H͡L	*H.$\underline{\text{M}}$*	#
	'You are going to sushi store						to buy	sushi'	

(4)

	li	be	k^hi	*su.ɕiʔ*	tiam		be	*su.ɕiʔ*	
	you	want	go	sushi	store		buy	sushi	
Surfacing tone	H	$\underline{\text{H}}$	H͡L	**H.$\underline{\text{H}}$**	L	#	H	*H.M*	#
(with tone sandhi)	'You are going to sushi store						to buy	sushi'	

Palatalization and Vowel Raising in Latvian

Olga Urek, CASTL/University of Tromsø, olga.urek@uit.no

The paper presents novel data on the complex interaction of palatalization and vowel raising in Latvian, and argues that representations are crucial for the OT analysis.

In Latvian, nouns of 2nd declension take a j-initial case suffix in genitive singular and in all plural cases (1a). Stem-final alveolars and alveolar clusters palatalize in this context and the glide of the suffix deletes (1b, 1c). Crucially, palatal assimilation only applies if the trigger is located in the same syllable as the target (1d). Palatalization never skips over a segment (1e).

1a./skap-ja/ → [ska.pja]	'closet,gen.sg'	cf.	/skap-is/ → [ska.pis]		'closet, nom. sg.'
1b./las-ja/ → [la.ʃa]	'salmon, gen. sg'	cf.	/las-is/ → [la.sis]		'salmon, nom. sg'
1c./pusl-ja/ → [pu:.ʃʎa]	'bladder,gen. sg'	*[pu:sʎa]	cf.	[pu:.slis]	'bladder, nom. sg
1d./vals-ja/ → [val.ʃa]	'waltz, gen. sg'	*[vaʎ.ʃa]	cf.	[val.sis]	'waltz,nom. sg'
/su:tn-ja/→ [sut.ɲa]	'envoy, gen. sg'	*[su:ʃ.ɲa]	cf.	[su:t.nis]	'envoy,nom.sg'
1e. /latv-ja/ → [la.tvja]	'Latvian,gen. sg'	*[la.ʃvja]	cf.	[la.tvis]	'Latvian, nom.sg'

There is also a process of vowel raising whereby /æ/ raises to [ɛ] when followed by palatal consonants (2a), vowels [i] and [ɛ] (2b) and the palatal glide /j/.

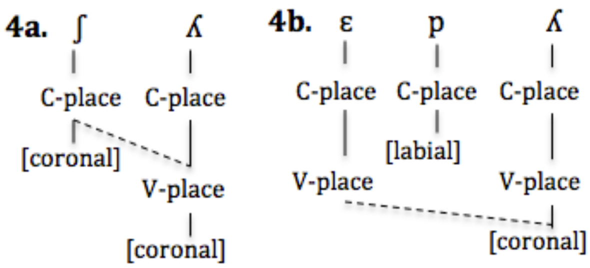
2a. /ræsn-**j**a/→ [rɛ.**ʃɲ**a]	'fatty, gen. sg'	cf.	/ræsns/→ [ræsns]	'fat, nom.sg'
2b. /mæl-**i**s/→[mɛlis]	'liar, nom. sg'	cf.	/mæl-uot/ →[mæluot]	'to lie'

Thus, palatal segments and front non-low vowels behave as a natural class in that they all trigger raising of /æ/. Following Clements (1991), I propose that palatal segments and front non-low vowels have a feature [coronal] attached to the V-place node and both palatalization and vowel raising is due to leftward spreading of V-place [coronal].

However, unlike palatalization, vowel raising applies even if the trigger and the target are located in different syllables, and can skip over consonants (3a), including consonants that potentially can host a V-place [coronal] feature (3b).

3a./t͡sæpl-ja/→[t͡sɛ.pʎa]	'oven, gen. sg'	cf	/t͡sæp-u/→ [t͡sæpu]		'bake, 1 pres.'
3b./ʃcærsl-ja/→ [ʃcɛr.ʃʎa]	'barrier,gen.sg'	*[ʃcɛrʲ.ʃʎa]	cf.	[ʃcærsuot]	'to cross'

In other words, even though both palatalization and vowel raising is due to the leftward spreading of V-pl[coronal], palatalization is strictly local, while vowel raising can apply long-distance. I argue that this is because the two processes are representationally distinct, despite being identical in terms of the spreading feature and directionality.



According to Clements (1991, 1995) and Moren (2003), *inter alia*, all vowels have a V-place node (though not necessarily terminal V-place features); plain consonants lack a V-place node altogether, while palatal consonants have a V-place node and a terminal feature attached to it. Both, nodes with terminal features attached to them and terminal features themselves, can spread. I propose that when spreading targets a vowel, what spreads is only the terminal feature [coronal] (because the vowel already has a V-place node that can host the feature), as in 4b, while when the target is a plain consonant, it is the whole V-place node with features attached that spreads (4a). Only once the two processes are differentiated representationally can the OT constraints that refer to each of them separately and restrict the scope of application to respective domains be formulated. In my analysis I am using Licensed Alignment Constraints (Jurgec 2011).

Cluster Reduction in Nordic Languages

Laurence Voeltzel, Université de Nantes (Lling EA 3827)

In Faroese, many internal or final underlying three-segment clusters are pronounced as two-segment clusters : they undergo reduction and thus lose a consonant before surfacing (see (1a'-i')).

(1) (a) /stør+ri/ [stør:i] *tall* $_{\text{comp. of sup.}}$	(a')/stø**r**+**s**t+ur/ [stø**s**tur] *tall* $_{\text{superl.}}$
(b)/spirn+a/ [spirna] *to hit* $_{\text{inf.}}$	(b') /spi**rn**+ti/ [spi**n**ti] *to hit* $_{\text{pret.}}$
(c) /jawn+ur/ [jawnur] *equal* $_{\text{masc.}}$	(c') /ja**vn**+t/ [ja**m**t] *equal* $_{\textit{neut.}}$
(d) /badn/ [badn] *child* $_{\text{nom.}}$	(d') /ba**dn**+s/ [ba**n**s] *child* $_{\text{gen.}}$
(e) /rign+a/ [rigna] *to rain* $_{\text{inf.}}$	(e') /ri**gn**+di/ [ri**ŋ**di] *to rain* $_{\text{pret.}}$
(f) /ring+ur/ [riŋgur] *bad* $_{\text{masc.}}$	(f') /ri**ng**+t/ [ri**ŋ**t] *bad* $_{\text{neut.}}$
(g) /yld+ur/ [yldur] *high (of meat)* $_{\text{masc.}}$	(g') /y**ld**+t/ [y**l**t] *high (of meat)* $_{\textit{neut.}}$
(h) /ʉti/ [ʉtɪ] *far away*	(h') /i**t**+**s**t/ [i**s**t] *far away* $_{\text{superl.}}$
(i) /stɷtt/ [stɷt:] *short* $_{\text{fem.}}$	(i') /stɪ**tt**+st/ [stɪ**s**t] *short* $_{\text{superl. fem.}}$

Rischel (1972 [2009]) sees regularity in the segments or clusters involved and gathers together some cases of reduction. For instance, he makes a difference between cases where /r/ disappears before a cluster (1a'-b'), cases where /t/ systematically drops (1h'-i'), and more generally, cases where /sonorant+obstruant+obstruant/ (or /obstruant+sonorant+obstruant) clusters undergo a change (1c'-g'). He concludes, that cluster simplification derives from various mechanisms, each of them targeting a specific segment class or group. In this sense, he proposes rules for each context, which makes reduction impossible to generalize.

We propose an analysis of reduction based on syllabic constraints which can explain every example illustrated in (1) and unify all the cluster simplification instances observed in Faroese. As we can see in (1), reduction exclusively involves complex codas followed by a consonant added by morphology. Codas seem to be constrained in Faroese: in final position complex codas are allowed, but in internal position and before another consonant only single codas are admitted. If required, elements preceding the morphemic boundary have to be simplified from two C-slots to one. In GP (KLV: 1990, Lowenstamm: 1996), this would be equivalent to a governing domain deletion:

(2) (a)
```
          //    PG            (b)       PG
C V [C V] C V C V     →       C V C V C V
*f i [d Ø] l Ø t i            f i l Ø t i
```

The first empty nucleus can remain empty because it is properly governed by the final nucleus. Being governed, it can't be a governor for the next nucleus. As a consequence the representation in (3a) violates the *ECP*. In order to avoid this situation, a strategy aiming to the deletion of the domain containing the non-governed nucleus can be triggered, leading to the loss of a consonantal position.

Examples like /ja**vn**+t/ [ja**m**t] and /ri**gn**+di/ [ri**ŋ**di] indicate that the consonant which was in the same domain as the non-governed nucleus does not completely disappear: its content moves to the next C-slot. The two segments sitting in one position merge together into a single consonant. We illustrate the segmental content with elements (KLV: 1988, Harris: 1994, Scheer: 1999). However, reduction does not always generate a third segment: sometimes one of the two consonants seems to lay its elements upon the content of the other consonant. While clusters simplification responds to syllabic constraints, the segmental class to which the reduced consonants belong allows us to predict the result of the merger. Every instance presented here involves a sonorant, however results vary according to the sonorant. Even if they belong to the same natural class, sonorants do not behave the same way. Following Backley (2011), we consider that segments have an internal organization: while all segments may have the same complexity, they differ in that they hierarchically structure their content in different ways.

Acquiring Markedness Constraints: The Case of French

Jeroen van de Weijer
Shanghai International Studies University

Marjoleine Sloos
University of Groningen

In 'classic' Optimality Theory, markedness constraints are part of Universal Grammar and, hence, innate (Prince & Smolensky 2004). In this presentation we investigate the possibility that constraints are *acquired* on the basis of data in the ambient language. Specifically, we investigate five general markedness constraints in French, and argue in favour of the position that these constraints are acquired, i.e. that no assumption of innateness is required. Second, we show that the order of acquisition of marked structures (nasal vowels, consonant clusters, etc.) matches the frequency of violations of the relevant markedness constraints in the input quite closely. We therefore argue in favour of a phonological model in which constraints are acquired, or, in more general terms, a model in which phonological grammar is derived from usage and in which innate properties are limited to general cognitive strategies and do not include specific notions like individual OT constraints.

We first introduce five markedness constraints that are relevant to French. Although all these constraints are uncontroversial and have been used in many previous analyses, we discuss potential problems of interpretation. We show why it has generally been assumed that constraints are innate in mainstream Optimality Theory and why this assumption is too hasty. We then turn to the lexical patterns that are relevant to the discovery and ranking of these constraints, based on corpus data. From the corpus patterns we derive three predictions regarding the order in which the marked patterns in French are acquired, relating to the relative stages of acquisition of nasal vowels and front rounded vowels, coda obstruents and coda sonorants, and onsetless syllables and clusters. These predictions are tested on the basis of available acquisition data for French. Finally, we discuss these findings in the light of a model of linguistic competence which is grammatical but usage-based.

Prince, Alan & Smolensky, Paul [2004]. Optimality Theory: Constraint Interaction in Generative Grammar. London: Blackwell.

A re-examination of Affrication

Connor Youngberg
267787@soas.ac.uk
SOAS, University of London

The phenomenon of affrication preceding front high vowels resulting in some form of alveo-palatal affricate has been well analyzed and discussed in the literature (e.g. Yoshida S. 1991, 2001; Ito & Mester 1989), however affrication without alveo-palatalization (i.e. /t/ to /ts/) has yet to receive a satisfactory analysis. I will examine both kinds of affrication with reference to Quebec French and Japanese .

In Japanese, there are two types of affrication which affect coronal stops: palatalization preceding /i/ and affrication without palatalization preceding /ɯ/.

katsɯ 'to win'	kadzɯ~kazɯ 'fire'
otɕirɯ 'to drop'	ɕindʑirɯ 'to believe'

Affrication is the change of a stop to an affricate, a consonant that begins as a stop and releases as a fricative. Palatalization is the addition of either a palatal secondary articulation or a change of place of articulation to palatal. Palatalization can be easily explained in monovalent feature theories such as Feature Geometry (Clements & Hume 1995) through regressive association of the [coronal] feature from V to C. In Element Theory (KLV 1985, 1990; Harris & Lindsey 1994; Charette & Göksel 1998; Cyran 2010; Backley 2011) it can be explained through regressive sharing of the [I] element giving palatal resonance. Affrication without palatalization cannot be transparently explained. There is no obvious link between the vowel /ɯ/ and the change of the coronal stop to a coronal affricate. In Element Theory [U] represents rounded vowels (e.g. /u/) and labial consonants (as well velar consonants in Backley 2011). One can assume the alveolar place spreads to the fricative portion of the affricate from /t/, but where is the frication coming from and why should the coronal affricate surface preceding /ɯ/? Quebec French also has affrication sans palatalization preceding the high vowels /i/ and /y/ e.g. [dzyr] 'hard' [tsip] 'type' (Kaye 1989). There is no palatalization however.

Height (unencoded in Element Theory), which is common to both contexts, seems to cause affrication in general, though no model currently predicts a link with height in vowels and affrication in stops. There seems to be no physical articulatory link between the character of the vowel /ɯ/ and the affrication of /t/ and /d/ in Japanese. There is a link between /i/ and affrication due to proximity to the alveolar ridge and palate but again this does not help us in relation to the case of Japanese affrication sans palatalization.

In this talk, we consider possible reasons for this affrication such as sound change aimed at fortition of the speech stream (Harris & Lindsey 1995; Ohala 1981, 1993; Blevins 2004, 2006, 2008) or feature spread related to height. I will also examine the role of phonological features and hearer bias in sound change (Harris & Lindsey 1995, Garrett & Johnson 2011) with proposed impacts on the grouping of subsegmental features and the application of structural approaches to phonology. I claim that this phenomenon is not articulatory and affrication is speech stream fortification, which is reasonable combined with an argument using structural proposals (Pöchtrager 2006) which replace the [H] element.

ON THE NATURE OF MORPHO-PHONOLOGICAL COMPUTATION

Sławomir Zdziebko
s.zdziebko86@gmail.com
Catholic University of Lublin

Polish shows several types of affix-specific palatalisations, e.g. /t/ may become /t͡ɕ/ or /t͡s/ when it is followed by /ɛ/, when this /ɛ/ is the exponent of different suffixes. Palatalizations have been analysed by postulating different abstract representations of different affixes, which were neutralised by means of ordered rules or constraints arranged into levels (see e.g. Laskowski 1975, Gussmann 1980, Rubach 2003). Gussmann (2007) describes Polish palatalizations as morpho-phonological replacements of segments triggered by diacritics attached to inflexional and derivational affixes in Polish. In my presentation I will elaborate on Gussmann's proposal by making following claims about how replacements work: i) morpho-phonological replacements take place at the Vocabulary Insertion stage of derivation under strictly local c-command (as defined in Embick 2010); ii) morpho-phonological replacements obey the Minimalist Hypothesis (Kaye 1992:141), i.e. they take place whenever their conditions are satisfied. The Minimalist Hypothesis (MH) makes several predictions about morpho-phonological computation: 1) no Palatalisation Replacement (PR) exists by which a segment A is replaced with B and a segment C is replaced by A (A should immediately go to B); 2) bleeding or counter-feeding configurations are banned; 3) there is no affix marked more than one diacritics each of which replaces the same segment with different segments (a mutual bleeding configuration); 4) MH predicts that an affix marked with a given diacritic must not trigger a subset of replacements associated with this diacritic.

The predictions are borne out in that: 1) Polish doesn't have a rule by which e.g. /t͡ʃ/ is turned into /t͡ɕ/ and /t/ into /t͡ʃ/; all apparent counterexamples to 2) and 3) must be treated as root-specific changes and not affix-specific changes. Prediction 4), however, can be easily 'defused' by postulating additional diacritics triggering subsets of more general replacements. This strategy was assumed by Gussmann (2007:154) in his analysis of the adjectival morph -*sk-* /sk/ which seems to regularly replace /n/ with /ɲ/ and /w/ with /l/ but doesn't trigger other replacements associated with the diacritic PR1, e.g. /t/ /t͡ɕ/ or /r/ /ʒ/. For comparison, a diminutive exponent *-y/ik-* /ɨ~ik/ triggers all four changes. Gussmann's solution is to mark -*sk-* /sk/ with another diacritic, PR1a, which triggers only /n/ /ɲ/ and /w/ /l/. For MH to retain its maximal empirical content, postulating diacritics triggering subsets of replacements must be disallowed. In order to achieve this I postulate the Unique Trigger Condition (UTC):

A link between a pair of segments *A* and *B* forming the input and the output of a replacement and the diacritic *D* triggering this replacement is a **function**, whose argument is the *A* *B* mapping and whose value is *D* so that *f*:(*A* *B*) ⟶ *D*

UTC says that whereas a single diacritic may trigger different replacements, one replacement may be triggered by only one diacritic. Moreover, I will make the case that a replacement triggered by a diacritic must not be triggered elsewhere by morpho syntactic features: once you are triggered by a diacritic, you are always triggered by a diacritic and all the exponents that trigger you must carry this diacritic.

In the presentation I will explore the consequences of the UTC for the relationship between replacements triggered by morpho-syntactic features and replacements triggered by diacritics: under the version of Vocabulary Insertion presented in Bobaljik (2000), the latter must never feed the former. I will also show that the replacements /n/ /ɲ/ and /w/ /l/, assigned by Gussmann to *-sk-* /sk/ are phonological and not morpho-phonological: Polish does not accept /w/+/s/ sequences: /w/ acquires the place of articulation of /s/ and turns into /l/. Similarly, /n/+/s/ is pronounced with /n/ as a nasalised vowel or glide /ĩ~j̃/. A constraint which forces all Polish nasal segments to be headed, forces vocalised /n/ to be pronounced as a palatal glide.

Special session

Harmony in Phonology

Restrictive theories of harmony

Andrew Nevins (University College London; Visiting Professor, UNICAMP)

This talk consists of three parts, which mirror the complementary importance of modelling, typological comparison, and experiments as crucially and mutually informative domains of inquiry in the study of harmony in phonology. In the first part I will discuss discrete *vs*. continuous approaches to variation in harmony, arguing that a model based on finite parameters provides a better empirical match to existing data than models based on continuous, numerically-valued scales. In the second I will discuss restrictions on directionality in harmony, providing comparative and loanword evidence that some seemingly bidirectional patterns of nasal harmony are in fact unidirectional, with the implication that bidirectional harmony is extremely rare. Finally I will discuss the limitations imposed by learning biases in a recent experiment we have conducted on sibilant harmony in two different artificial grammar comparisons, in which initial syllable protection interacts with affix-driven harmony, demonstrating that under certain conditions, learners actively avoid 'strictly local' harmony.

Tone patterns: phonotactics and allomorph selection

Douglas Pulleyblank (University of British Columbia)
[Joint work with Diana Archangeli; relevance to harmony has been assured]

Conventional generative approaches to morphophonological alternation depend on the postulation of underlying representations. Actually occurring allomorphs are derived from the abstract representations (whether by rule or by constraint satisfaction). Here we consider an alternative view: surface allomorphs are related by redundancy rules, and allomorphs appropriate for a given context are identified by general phonotactics in combination with morpheme-specific selectional constraints.

The phenomena under consideration involve tonal behaviour, the sorts of properties considered by Goldsmith (1976) to argue for the autosegmental hypothesis. The cases in point are Kinande (Mutaka 1990) and Margi (Hoffmann 1963), which show many properties associated with both autosegmental and more general behaviors: many-to-one association, one-to-many association, melodies, polarity, iterativity. The essence of our approach is to derive the relevant properties from constraints holding of actually occurring allomorphs. That is, no abstract "underlying representations" are posited. Surface-based phonotactics and morphological selectional requirements govern the patterns of allomorphs observed on the surface. In Margi, for instance, three surface phonotactics - a strong prohibition on HL sequences, a weak prohibition on LH sequences, and a restriction limiting contours to word-final position - govern tonal patterns on morphemes with level H, level L, rising and changing tone patterns. Selectional requirements govern instances of tonal polarity in Margi. In Kinande, we show that apparent instances of noniterative tone spreading are the result of particular morphemes selecting for the tone of an adjacent morpheme.

The approach to phonological data taken here is one that minimises the role of Universal Grammar, reducing or eliminating the need for UG principles and constraints. The proposed "Emergent Grammar" framework takes a "bottom-up" approach to analysis, positing representations and both lexical and phonological relations among representations.

References

Goldsmith, John. 1976. Autosegmental Phonology. Doctoral dissertation, MIT.
Hoffmann, Carl. 1963. A Grammar of the Margi Language. London: Oxford University Press.
Mutaka, Ngessimo. 1990. The Lexical Tonology of Kinande. Doctoral dissertation, University of Southern California.

The close-ups can get rough: exceptional behaviour, transparency and variation in Hungarian vowel harmony

Miklós Törkenczy (Eötvös Loránd University Budapest; Hungarian Academy of Sciences)

When we study phonological patterns we want to make (typological) generalisations on the one hand and want to attain descriptive accuracy and coverage on the other. If the pattern is sufficiently complex, mismatches between these two goals are bound to occur. Some of these mismatches are insignificant since they parochial and can be fixed without far-reaching consequences. Systemic mismatches, when some mismatch is associated with theoretical assumptions or their implementation in the 'built-in' formal machinery of the analysis, are important because they have theoretical significance. In this talk I will review some interesting systemic mismatches that manifest themselves when we adopt a more close-up view of some lesser known or hitherto unanalysed aspects of Hungarian vowel harmony.

Exceptions to vowel harmony
There is a general agreement in the literature that exceptions to vowel harmony are strictly local and morpheme-specific: consequently, exceptional transparency is impossible. Of the four possible types of exceptionality (exceptional non-undergoers, exceptional undergoers, exceptional triggers and exceptional non-triggers), exceptional non-triggers are unattested and are considered to be impossible by some and predicted to exist by others (Finley 2010, Mahanta 2012, Nevins 2010). I will examine a class of stems that are exceptional non-triggers of rounding harmony ('lowering' stems) and a class of stems that propagate their exceptional property ('anti-harmony') long-distance across a transparent vowel (Rebrus, Szigetvári & Törkenczy 2012, Rebrus, Szigetvári & Törkenczy to appear),.

Neutrality, transparency and invariance
According to Kiparsky and Pajusalu (2003) those vowels are neutral in a given language that do not have a harmonic partner in the inventory or that are contextually prevented from changing into their harmonic partners in a particular (prosodic) domain. Neutral vowels are also claimed to be uniform in that all neutral vowels with a given value of

the harmonic feature are either opaque or transparent in a language. Hungarian is doubly problematic in this respect: although transparency is related to participation in alternation, the (in)ability to alternate cannot be derived from markedness or positional faithfulness. Some neutral/transparent vowels do have a harmonic pair in the inventory and participate in regular harmonic suffix alternations. Furthermore, one and the same neutral vowel may be opaque or transparent depending on whether it alternates or not in a suffix: this state of affairs violates uniformity since a vowel with a given value of the harmonic feature is sometimes opaque, other times transparent (Rebrus, Szigetvári & Törkenczy 2012, Rebrus, Szigetvári & Törkenczy to appear, Törkenczy 2011)

Variation and lexical conditioning

Hungarian vowel harmony is stem-controlled. There is variation in backness harmony after mixed stems consisting of a back vowel followed by (a number of) neutral vowels. This variation is stem-specific in that mixed stems of the same phonological shape (i.e. harmonic properties) may differ in their behaviour: some take front suffix alternants only, some only take back ones, others take both (Ringen& Kontra 1989, Hayes and Londe 2006, Siptár & Törkenczy 2000). While it is usually assumed that -- in accordance with stem-control -- lexical conditioning in this 'zone of variation' (Hayes and Londe 2006) is stem-specific, it can be shown that the lexical conditioning of variation is more complex: different suffixes of the same harmonic properties may show different behaviour with the same stem, i.e. variation in backness harmony is not only stem-specific, but suffix-specific too.

References

Finley, Sarah 2010. Exceptions in vowel harmony are local. Lingua 120, 1549-1566.

Hayes, Bruce and Zsuzsa Cziráky Londe (2006). Stochastic phonological knowledge: The case of Hungarian vowel harmony. Phonology 23. 59-104.

Kiparsky, Paul and Karl Pajusalu (2003). Towards a Typology of Disharmony. The Linguistic Review 20: 217-241.

Mahanta, Shakuntala (2012). Locality in exceptions and derived environments in vowel harmony. Natural Language & Linguistic Theory 30:1109-1146.

Nevins, Andrew (2010). Locality in Vowel Harmony. Cambridge, Mass: MIT Press.

Rebrus, Péter, Péter Szigetvári & Miklós Törkenczy. 2012. Dark secrets of Hungarian vowel harmony. In: Sound, Structure and Sense: Studies in memory of Edmund Gussmann, Eugeniusz Cyran, Henryk Kardela & Bogdan Szymanek (ed.) Lublin: Wydawnictwo KUL. 491-508.

Rebrus, Péter, Péter Szigetvári & Miklós Törkenczy. to appear. Harmony that cannot be represented. In: Approaches to Hungarian. Papers from the 2011 Lund Conference Volume 13 John Benjamins

Ringen, Catherine & Miklós Kontra. 1989. Hungarian neutral vowels. Lingua 78. 181-191.

Siptár, Péter and Miklós Törkenczy. (2000). The phonology of Hungarian. Oxford: Oxford University Press.

Törkenczy, Miklós . 2011. Hungarian Vowel Harmony. In: The Blackwell companion to phonology. 5 vols., Marc van Oostendorp, Colin J. Ewen, Elizabeth Hume & Keren Rice (eds.) Malden, MA & Oxford: Wiley-Blackwell. 2963-2990.

Consonant harmony and vowel harmony: comparisons in typology and sources for nonlocality

Rachel Walker (University of Southern California)

A notable feature of many harmony systems is their capacity for action-at-a-distance. Long-standing questions surround what gives rise to nonlocal segmental interactions and the mechanisms that make them possible. The segments that interact in harmony and those that behave as transparent are connected to harmony systems' potential for long-distance activity. While it would be appealing to unify the analysis of vowel harmony (VH) and consonant harmony (CH), they show typological differences in certain respects pertaining to interacting segments and transparent segments. This talk investigates these issues, aiming (i) to probe the relational dimensions and structures that enable interactions among nonadjacent segments, and (ii) examine areas of typological difference between VH and CH.

A core insight stemming from typological studies of CH is that similar consonants are more prone to interact (Hansson 2001, 2010, Rose & Walker 2004, Gallagher & Coon 2009). This observation connects to a proposed source for nonlocal interactions. It has been proposed that similarity can give rise to the formation of relations between segments that can transcend adjacency. In the similarity-driven Agreement by Correspondence approach, correspondence relations are established between similar segments in an output, and these relations may be formed even if the segments are nonadjacent (Walker 2000a, b, 2001, Hansson 2001, 2010, Rose & Walker 2004).

Proposals have been made to analyze VH in the Agreement by Correspondence approach (Hansson 2006, Sasa 2009, Walker 2009, Rhodes 2010). However, there are areas where this approach is problematic for VH. The first issue involves inventory-sensitive sources for nonlocal interactions, as illustrated by a pattern of ATR harmony in Lokaa with transparent high vowels (Akinlabi 2009). This points to a need for forms of sensitivity to contrast (for recent contributions on this topic, see, e.g., Krämer 2003, Calabrese 2005, Dresher 2009, MacKenzie 2009, Nevin 2010, among others). Second, VH that necessarily involves vowels that show prominence differences does not conform with the predictions of similarity-driven interactions, as illustrated by the Eastern Meadow dialect of Mari (Vaysman 2009). Based on these types of systems, it has been proposed that prominence differences can form the basis for interactions that are potentially nonlocal, formalized in terms of prominence-based licensing (Walker 2006, 2011, Jiménez & Lloret 2007, Lloret 2007). A third area of difficulty involves patterns with biases for triggers with perceptually weak vowel qualities. For instance, in the typology of round harmony, front vowels – which show comparatively weak acoustic cues for rounding – are favored as triggers (Kaun 1995). An example is found in the asymmetrical round harmony of Kazakh (Korn 1969), which does not align with a purely similarity-driven account of VH.

In summation, CH and VH show some characteristics that do not look promising for unification. However, insights about sources of nonlocality in the form of similarity and prominence asymmetries emerge from the comparison, and areas for further discussion and research are delineated.

References

Akinlabi, A. 2009. Neutral vowels in Lokaa harmony. CJL 54, 197–228.

Calabrese, A. 2005. Markedness and Economy in a Derivational Model of Phonology. Berlin: Mouton de Gruyter.

Dresher, B. E. 2009. The Contrastive Hierarchy in Phonology. Cambridge University Press.

Gallagher, G. & J. Coon. 2009. Distinguishing total and partial identity. NLLT 27, 545–582.

Hansson, G. Ó. 2001. Theoretical and Typological Issues in Consonant Harmony. PhD dissertation, UC Berkeley.

Hansson, G. Ó. 2006. Locality and similarity in phonological agreement. Paper presented at the workshop on Current Perspectives on Phonology. Indiana University, June 23, 2006.

Hansson, G. Ó. 2010. Consonant Harmony: Long-Distance Interaction in Phonology.Berkeley: University of California Press.

Jiménez, J. & M.-R. Lloret. 2007. Andalusian vowel harmony: Weak triggers and perceptibility. Paper presented at the 4th OCP, Rhodes, January 18–21, 2007.

Kaun, A. 1995. The Typology of Rounding Harmony: An Optimality Theoretic Approach. PhD dissertation, UCLA.

Korn, D. 1969. Types of labial harmony in the Turkic languages. Anthropological Linguistics 11, 78–92.

Krämer, M. 2003. Vowel harmony and correspondence theory. Berlin: Mouton de Gruyter.

Lloret, M.-R. 2007. On the nature of vowel harmony: Spreading with a purpose. Proceedings of the XXXIII Incontro di Grammatica Generativa, ed. by Antonietta Bisetto & Francesco E. Barbieri, 15-35. Dipartimento di Lingue e Letterature Straniere Moderne, Università di Bologna.

Mackenzie, S. 2009. Contrast and Similarity in Consonant Harmony Processes. PhD dissertation, University of Toronto.

Nevins, A. 2010. Locality in Vowel Harmony. Cambridge, MA: MIT Press.

Rhodes, R. 2010. Vowel harmony as Agreement by Correspondence. Ms., UC Berkeley.

Rose, S & R. Walker. 2004. A typology of consonant agreement as correspondence. Language 80, 475–531.

Sasa, T. 2009. Treatments of vowel harmony in Optimality Theory. PhD dissertation, University of Iowa.

Vaysman, O. 2009. Segmental Alternations and Metrical Theory. PhD dissertation, MIT.

Walker, R. 2000a. Long-distance consonantal identity effects. Proceedings of WCCFL 19, 532–545. Somerville, MA: Cascadilla Press.

Walker, R. 2000b. Yaka nasal harmony: Spreading or segmental correspondence? Proceedings of BLS 26, 321–332. Berkeley Linguistics Society.

Walker, R. 2001. Consonantal correspondence. Proceedings of the Workshop on the Lexicon in Phonetics and Phonology. Papers in Experimental and Theoretical Linguistics, Vol. 6, 73–84. Edmonton: Department of Linguistics, University of Alberta.

Walker, R. 2006. Long-distance metaphony: A generalized licensing proposal. Paper presented at the workshop on Current Perspectives on Phonology. Indiana University, June 23, 2006.

Walker, R. 2009. Similarity-sensitive blocking and transparency in Menominee. Paper presented at the annual meeting of the Linguistic Society of America, San Francisco, CA, Jan. 9, 2009.

Walker, R. 2011. Vowel Patterns in Language. Cambridge University Press.