What is wrong with the right side?
Edge (A)symmetries in phonology and morphology

Martin Krämer
University of Ulster
m.kraemer@ulster.ac.uk

Abstract

This paper investigates exceptions to phonological regularities at the right edge of words. I will concentrate on two phenomena, regressive vowel harmony and its motivation, and the phonotactics of consonants at right word edges in languages where these are exceptional to word-internal coda consonants. Exceptional final consonants gave rise to theories of minor syllables with empty nuclei. This view is challenged in this paper. The left-right asymmetry within morphology and phonology has been addressed by Bye and de Lacy (2000). Within the framework of Optimality Theory they conclude that, given the asymmetries in affixation and stress placement we find cross-linguistically, we should exclude constraints referring to right edges from the universal constraint inventory. The current study shows that this strong hypothesis is not tenable and replaces it by a more general cognitive meta-constraint, which captures left-edge tendencies as emerging from a general lexical~functional asymmetry.

1. Introduction

There are two types of asymmetries in phonology and morphology which I would like to concentrate on in this paper. One was captured rather recently as an optimality-theoretic meta-constraint by McCarthy & Prince (1995). Dealing with reduplication phenomena they found that usually within phonological processes elements within the morphological root or stem of a word act as triggers while elements in affixes are targets or undergoers of phonological changes. Featural neutralisation is much more likely to affect segments in affixes than in stems. Many languages display a restricted inventory of sounds in affixes as compared to the contrasts found within roots or stems. Within Correspondence Theory McCarthy & Prince (1995) attributed this asymmetry between lexical and functional elements to a universal meta-ranking of two types of faithfulness constraints. Faithfulness to roots is universally ranked higher in the otherwise language-particular constraint hierarchies than is affix faithfulness.

(1) The root-affix meta constraint (McCarthy & Prince 1995)
      Universal ranking: FAITHroot >> FAITHaffix

A related observation was made much earlier by Trubetzkoy (1939) and was later taken up by Casali (1997) and Beckman (1998), saying that phonological material can resist neutralisation at the left edge of a morphological constituent but not at the right edge. Beckman (1998) formalised this in her theory of positional faithfulness as a

faithfulness constraint referring to the left edge of roots. The mirror image constraint, referring to the right edge of roots is said to be absent from universal grammar.

(2) First syllable root faithfulness (Beckman 1998: 56)
Let β be an output segment in the root-initial syllable, and α its correspondent.
If β is [γF] then α is [γF].
"An output segment in σ1 and the input correspondent of that segment must have identical feature specifications."

The third observation relates to morphological structure alone. Sapir (1949) observed and Greenberg (1957) confirmed that languages with suffixes are much more frequent than languages with prefixes. Suffixation is considered as the unmarked case, while prefixation is highly marked and usually subject to more phonological restrictions than suffixation. For instance, there is often no resyllabification over the left root edge in suffixing languages which also allow some prefixes.
    The two resulting asymmetries are summarised in (3).

(3) Two asymmetries
    i. The Lexical~Functional asymmetry:
         Stems are more resistant to neutralisation than affixes.
    ii. The Left-Right asymmetry:
        a. The left edge of words is more resistant to neutralisation than the rest.
        b. Languages prefer suffixation over prefixation.

On the basis of (3ii) and on the grounds of an observation made by Hayes (1985, 1995) that iambic footing almost always goes from left to right rather than right to left, Bye & de Lacy (2000) argue for a reduction of the constraint component within Optimality Theory, excluding constraints referring to the right edge of any constituent from Universal Grammar.

(4) Edge-Asymmetry-Hypothesis (EAH) (Bye & de Lacy 2000: 122):
No constraint may refer to the right edge of a constituent.

There are however quite a few apparent exceptions to this generalisation.[1] Bye & de Lacy discuss some of these and propose analyses which maintain their hypothesis.

---

[1] Kaye (1995) formalises a similar idea in Government Phonology. Rejecting the idea of derivations he assumes that every word consists of minimally one phonological domain. All lexical items and some affixes can constitute an independent phonological domain which may be integrated together with other structure in a superordinate domain. He allows only one asymmetric analytic structure, the one with the weaker element to the right. According to him the structure in (i.c) is universally not a well-formed structure.
    i. Analytic word structures (Kaye 1995):
        a. [[A] [B]]
        b. [[A] B]
        c. *[A [B]]

Many cases which are not discussed by Bye & de Lacy defy analysis without reference to the right edge.

Such cases involve languages with right oriented stress patterns such as French or Turkish, where the last syllable in the word is stressed, languages with exclusive pre-fixation such as Yoruba (Pulleyblank 1996), languages with suffixation, and affix controlled vowel harmony (i.e., a vocalic assimilation pattern going exclusively from right to left) such as Futankoore Pulaar (Paradis 1992, Breedveld 1995, Krämer 2001) as well as large scale exceptions to coda conditions at the right edge of words (e.g., Piggott 1999). In the latter cases we find neutralisation of codas or no coda consonants at all within words, but often the full inventory of consonants at the right edge of words, i.e., in apparent coda position.

Bye & de Lacy discuss the case of Cairene Arabic in this respect. Cairene Arabic has no tautosyllabic consonant clusters, except at the right edge of words. The extra consonant at the right word edge is analysed as a minor syllable by Bye & de Lacy. The concept of minor syllables is very similar in spirit to the licensed syllables of Government Phonology (Kaye, Lowenstamm & Vergnaud 1990). Though the empty nuclei in Government Phonology have the advantage of freeing the theory from the category of the coda the cost for this is too high. The assumption of phonological structure in surface representations which has no phonetic correlate is problematic.

In this paper I argue for an extra-grammatical asymmetry hypothesis, which relates the observed asymmetries to a more general communicative demand of treating lexical material in a privileged way in contrast to phonological material associated with functional morphemes. For communicative purposes it is more important for the listener to detect phonemic contrasts and identify lexical items to retrieve their meaning than to detect functional information. Contrary to Bye & de Lacy's hypothesis I assume that grammar does supply the full range of possibilities to parameterise constraints with respect to the left or right edge.

(5) Lexical Privilege Hypothesis:
  Contents is more important than structural information.
  Consequences:
    a. Lexical material tends to be chronologically ordered first.
    b. Lexical material tends to be neutralised last.

This hypothesis does not refer to any edges as such, but it can affect the ordering of morphemes and what is more important it affects the ordering of constraints. Left-alignment or left-anchoring constraints referring to lexical material as well as faithfulness constraints referring to lexical material are dragged to the top of hierarchies by this meta-principle, though not compulsorily. As sketched above this meta-constraint is grounded in considerations on the optimisation of communication. Furthermore we can maintain the symmetry of constraint schemes such as the alignment or anchoring scheme which refers to both possible edges. Reference to the right edge of linguistic

categories has the consequence that we are able to formulate a faithfulness constraint on the right edge of words. As will be shown in this paper there is quite clear evidence for such a constraint. Accepting this we can analyse final consonants as what they are, as at the end of the word, and dispense with the assumption of empty nuclei in this position altogether.

In the following I will discuss cases for which the rigid EAH is too strong and suggest analyses which crucially make reference to right edges of morphemes. Furthermore, I will discuss how a ranking of root-specific faithfulness above affix faithfulness can have effects that obviously contradict the communicative purpose of this ranking. The most intriguing example is that of affix controlled vowel harmony in Futankoore Pulaar, a dialect of Fula. Following Bakovic (2000) Krämer (2001a,b) argues that root or stem control in vowel harmony systems cannot be attributed solely to a ranking of Identity constraints on roots over identity constraints on affixes. The analysis proposed in Krämer (2001a,b) relies on a ranking of positional anti-assimilation constraints which are formulated as faithfulness constraints as well. These constraints prohibit the realisation of an underlying feature on more segments in the output than in the underlying form. Restricted over roots and affixes respectively such constraints favour the affix-controlled pattern if the constraint on roots is more important than that on affixes.

The example contradicting the observation on affixes comes from Yoruba. This language has only prefixes and a root-controlled vowel harmony pattern with a remarkable right-left asymmetry.

Finally I will discuss right edge effects on coda consonants, examining languages which have a structural requirement to have a consonant at the right edge of the word, such as Yucatec Maya, and those which allow more colourful coda consonants in this position than elsewhere in the word. The analysis will dispense with the assumption of minor syllables with empty nuclei or without nuclei.

2. Reversed harmony

If in a language all vowels in a word systematically agree with respect to one or more articulatory features this cooccurrence restriction is generally referred to as vowel harmony. The majority of vowel harmony systems is assumed to be of the root controlled type (van der Hulst & van de Weijer 1995). In this type of harmony the triggering vowel is usually found in the root or stem of a word while the alternating or target vowels are usually found in affixes. Since most languages displaying vowel harmony are more or less strictly suffixing languages the process usually applies from left to right (if conceived of as processual). In some African languages (see van der Hulst & van de Weijer 1995 or Baković 2000 for examples) the morphological affiliation of the vowel does not matter. A vowel with a certain feature specification imposes this specification on all other vowels in the harmonic domain. This type of harmony is labelled dominant-recessive since one feature specification appears to be dominant and the other recessive. Harmony appears to be bidirectional in these lan-

guages. In the following I will discuss two exceptions to this typology. In Futankoore Pulaar (Paradis 1992, Breedveld 1995) the triggering vowel is found in the rightmost vowel of the word, which is an affix vowel due to the morphological preferences of the language. This produces affix-controlled harmony, which is phonologically exceptional. The Niger-Congo language Yoruba has only prefixes. It is thus morphologically exceptional. Furthermore the harmony process is strictly leftward in this language as well.

2.1 Regressive affix control

The Futankoore dialect of Pulaar has the vowel system displayed in (6). The feature advanced tongue root (ATR) plays no role in either high or low vowels. High vowels always have an advanced tongue root position while there is only one low vowel, namely the one with a retracted tongue root position. The only vowels which can have either tongue root position are the two mid vowels. The only position in which the ATR distinction among mid vowels can lead to a phonemic contrast is in word-final position, as will be shown shortly.

(6) Pulaar vowel inventory

+ATR	i	e		o	u
−ATR		ɛ	a	ɔ	

The language is strictly suffixing. If the root vowel contains a mid vowel the vowel of the following affix determines the ATR value of the root vowel as shown in (7). In (7a) the mid root vowel is followed by a high and thus invariably advanced vowel. In agreement with this vowel the root vowel has an advanced tongue root position as well. In (7b) the same roots are followed by an affix with a mid vowel with retracted tongue root. In this environment the root vowel surfaces as retracted in harmony with the following vowel.

(7) Pulaar mid stem vowels and harmony

a. ATR words	gloss	b. RTR words	gloss
sof-ru	'chick'	cɔf-ɔn	'chick'-dim.pl.
ser-du	'rifle butt'	sɛr-ɔn	'rifle butt'-dim.pl.
ᵐbeel-u	'shadow'	ᵐbɛɛl-ɔn	'shadow'-dim.pl.
peec-i	'slits'	pɛɛc-ɔn	'slits'-dim.pl.
beel-i	'puddles'	bɛɛl-ɔn	'puddles'-dim.pl.
dog-oo-ru	'runner'	dɔg-ɔ-w-ɔn	'runner'-dim.pl.
lot-oo-ru	'washer'	lɔt-ɔ-w-ɔn	'washer'-dim.pl.

(Paradis 1992: 87)

While the data in (7) show that there is no possibility for a phonemic function of the feature ATR in mid root vowels, the data in (8) show the contrastive function of this feature in affix vowels. The mid affix vowels in (8a) have an advanced tongue root

position and the root vowels assimilate to this. The mid affix vowels in (8b) are retracted and trigger retraction in the preceding root vowel.

(8) Pulaar dominant *e* and *o*

a. ATR forms	b. non-ATR forms	gloss	
lef-ol		'ribbon'	
lef-el	lɛf-ɔn	dim. sg. and pl.	
keer-ol		'boundary'	
keer-el	kɛɛr-ɔn	dim. sg. and pl.	(Paradis 1992: 90)
paɗ-el	paɗ-ɔn	'shoe dim. sg. and pl.'	(Paradis 1992: 1)

In Pulaar all nouns carry a class marker and verbs are followed by inflectional affixes. Hence roots never occur without an affix. If a root has a mid vowel it is thus not possible to determine the underlying ATR specification of this vowel.

The harmony pattern is disrupted if the root contains a high vowel and the affix(es) contains a mid retracted vowel. In this environment the disharmonic form is preferred to a reversal of the regressive assimilation pattern.

(9) Pulaar high stem vowels and harmony

dill-ɛrɛ	'riot'	*dillere	
fuy-ɛrɛ	'pimple'	*fuyere	
bin^{n}d-ɔɔ-wɔ	'writer'	*bin^{n}doowo	(Paradis 1992: 87)
tum^{m}bu-kɔn	'small calabashes'	*tum^{m}bukon	(Paradis 1992: 1)

As mentioned above the low vowel is invariably retracted. If a root with a low vowel is followed by affixes with advanced vowels, we observe disharmony as well.

(10) Pulaar low root vowels

^{m}bar-oo-di	'lion'	*^{m}barɔɔdi	
bar-o-gel	'lion'(dim.)	*barɔgel	(Paradis 1992: 94)
ɓal-w-ee-ki	'blackness'		(Paradis 1992: 127)

Low as well as high vowels in affixes trigger harmony in preceding mid root vowels as well (see 11 and 12).

(11) The low vowel in affixes

bɔɔt-aa-ri	'lunch'	*bootaari	
pɔɔf-aa-li	'breaths'	*poofaali	
nɔdd-aa-li	'call'	*noddaali	
^{ŋ}gɔr-aa-gu	'courage'	*^{ŋ}goraagu	(Paradis 1992: 88)

(12) Pulaar high vowels in affixes

a. ATR forms	gloss	b. RTR forms	gloss
ɓet-ir-de	'to weigh with'	ɓɛt-dɛ	'to weigh'

hel-ir-dɛ	'to break with'	hɛl-dɛ	'to break'
ɗokk-iɗ-dɛ	'to become one-eyed'	ɗɔkk-ɔ	'one-eyed person'
feyy-u-dɛ	'to fell'	fɛyy-a	'to fell (imperfective)'

(Paradis 1992: 87)

The data in (12) also show the immunity of the rightmost vowel in the word to the harmony process. In case this position is occupied by a mid and thus potentially alternating vowel, this vowel does not agree with a preceding high or low, i.e., non-alternating, vowel, regardless of the morphological affiliation of this preceding vowel.

We can say that the harmony "process" is strictly leftward and analyse this with an alignment constraint which aligns the ATR feature with the left edge of the word (see Smolensky 1993, Kirchner 1993, Pulleyblank 1996 among others for alignment approaches to vowel harmony). This would be in accordance with Bye & de Lacy's hypothesis. However, this would not explain the hegemony of the rightmost morpheme as the tableau in (13) shows.

(13)

/lɛf -ol/	ALIGN(ATR,L, word, L)	IDENT(ATR)

a.   -ATR   +ATR
     | |
   l   ɛ   f   o   l
	*!	

●☞ b.   -ATR
            ╱╲
   l   ɛ   f   ɔ   l
		*

☞ c.   +ATR
            ╱╲
   l   e   f   o   l
		*

Markedness cannot be the deciding factor since both ATR values at the right side of the word spread to the left (compare the data in 8). If markedness were the driving force we would expect a dominant-recessive pattern. Thus an appropriate analysis has to explain the triggering capacity of the rightmost vowel. The only reasonable analysis is one with a positional faithfulness constraint on the right edge of the word.

(14) IDENTRight: The rightmost vowel in the output is identical in feature F with its correspondent in the input.

(15)

/lɛf -ol/	IDENTRIGHT	ATR HARMONY	IDENT(ATR)
a. -ATR +ATR | | l ɛ f o l		*!	
☠ b. -ATR ∧ l ɛ f ɔ l	*!		*
☞ c. +ATR ∧ l e f o l			*

One could suspect that it is not the right edge of the word which is important here but rather the morpho-syntactic role of the affix triggering the process. A positional faithfulness constraint referring to the morpho-syntactic head was proposed to account for asymmetries in Greek stress patterns in Revithiadou (1998). A harmony process in which vowel harmony is triggered by the morpho-syntactic head of a word was identified in Jingulu by Pensalfini (2002). In this language it is only a closed class of affixes that triggers harmony, whereas in Pulaar all affixes trigger harmony. Furthermore, in words with an opaque vowel in the penultimate affix, this opaque vowel triggers harmony in the preceding vowels as well (see 11 and 12). This would not be expected if the morpho-syntactic head status were crucial to the analysis. Pensalfini analyses Jingulu with a ranking of affix faithfulness above root faithfulness in the language's constraint hierarchy, in contradiction of McCarthy & Prince's universal meta ranking.[2]

Krämer (2001b) takes a different route in the analysis of the root control/affix control dichotomy. As pointed out by Bakovic (2000), the mere ranking of root identity constraints over affix identity constraints does not account for the fact that in root controlled systems a harmonic affix vowel which is stuck between an opaque stem vowel and another opaque affix vowel always agrees with the stem vowel. As Krämer (2001b) observes the reverse is the case in Futankoore Pulaar. The vowel between opaque root vowel and opaque affix vowel consistently agrees with the affix vowel., Krämer considers 'anti-harmony' constraints rather than identity constraints in the analysis. The 'anti-harmony' constraints of the INTEGRITY constraint family demand that the features of a given underlying segment are mapped only to one segment in the surface representation. This view is based on Lamontagne & Rice (1995), who discuss constraints against multiple correspondence.

(16) a. INTEGRITY — "No Breaking" (McCarthy & Prince 1995)

No element of S_1 has multiple correspondents in S_2.

For x ∈ S_1 and w, z ∈ S_2, if x ℜw and x ℜz, then w = z.

---

[2] For further examples of a reversal of the meta ranking see Ussishkin's (2000) analysis of Modern Hebrew verbs and Noske's (2000) account of Turkana vowel harmony.

b. INTEGRITY(F) — "No assimilation" (Krämer 2001a,b)
No feature of S_1 has multiple correspondents in S_2.

ii. Positional Integrity:
   a. INTEGRITY(F)Affix
      No feature of an affix in an input has multiple correspondents in the output.
   b. INTEGRITY(F)Root
      No feature of a root in an input has multiple correspondents in the output.

These constraints block harmony or spreading only in a theory which regards harmony as correspondence between adjacent feature bearing units within one representation. The triggering vowel corresponds with its underlying representation via an input-output faithfulness relation, and there is an additional syntagmatic correspondence relation with the target vowel. The target vowel thus stands in an indirect correspondence relation with the underlying form of the triggering vowel. In this sense the underlying representation of the triggering vowel is mapped to more than one surface segment and has multiple correspondents. To account for affix control, INTEGRITYRoot has to rank above INTEGRITYAffix, while in root controlled systems INTEGRITYAffix outranks INTEGRITYRoot.

(17)   a. Root control: INTEGRITYAffix >> INTEGRITYRoot
       b. Affix control: INTEGRITYRoot >> INTEGRITYAffix

This not only contradicts McCarthy and Prince's meta ranking, but actually shows that in the majority of languages with vowel harmony, affix faithfulness outranks root faithfulness, and only the minority which display affix control have the ranking that was assumed to be universally fixed.

   For the details of the analysis of the Futankoore Pulaar harmony patterns the reader is referred to Krämer (2001b). This rather cursory account suffices for the current purposes. Though an alignment constraint referring to the left edge suggests itself here at first glance a closer look reveals the problem of a left-edge oriented approach with these data as well as the challenge posed to the root-affix meta constraint.

2.2 Regressive root control

In a linguistic world where the leftmost syllable of the root is the best place for phonological features to be we would expect vowel harmony to be triggered by the leftmost root vowel even in strictly prefixing languages. Yoruba shows that this is not the case. The language shows further that in a prefixing language the rightmost vowel in the root has a particularly privileged status. This is a completely unexpected situation if grammar were only left-edge oriented.

   Yoruba has ATR harmony just as Futankoore Pulaar. The harmony pattern is also apparently strictly leftward. The vowel system of Yoruba shows a similar asymmetry as that of Futankoore Pulaar. Only the mid vowels are potential targets of vowel har-

mony since only these vowels have the potential to alternate in their ATR specification. The high and low vowels have a fixed ATR value. High vowels are always advanced and low vowels are always retracted.

(18) Yoruba vowel inventory (Pulleyblank 1996: 297)

+ATR	i	e		o	u
−ATR		ɛ	a	ɔ	

The language has prefixes only. Functional elements following noun or verb stems are always enclitic and do not take part in the ATR harmony. Prefixes containing a mid vowel depend in their ATR specification on the following root vowel (19).

(19) Harmony with prefixes
  a. [oʃewe] 'publisher'   ò/ɔ̀ + /ʃèwé/   'publish a book'
     [oɟowu] 'jealous person'   ò/ɔ̀ + /jowú/   'be jealous'

  b. [ɔkɔsɛ] 'person who refuses to run errands'   ò/ɔ̀ + /kɔ/ /iʃɛ/ 'refuse' 'message'
                                                              (Pulleyblank 1996:306)

(20) No harmony with enclitics (Pulleyblank 1996: footnote 7)
    a. gbàgbé rɛ   'forget it'
    b. pè ɔ   'call you'

Apart from the strict habit of prefixing, the language shows a remarkable disruption of the harmony pattern at the right edge of the word. As noted above the only vowels which can possibly alternate to accommodate the harmony requirement are the mid vowels. The low vowel is opaque to the harmony pattern. It has no influence on the vowel to its right (21a,b), but relentlessly determines retraction of the tongue root in all mid vowels to its left (21c).

(21) Yoruba stems and positional prominence
    a. [aɟɛ]   'witch'   b. [afe]   'Spotted Grass-mouse'
       [abɛrɛ]   'needle'   [awo]   'plate'
       [aʃɔ]   'cloth'   [adi]   'palm-nut oil'

    c. [ɛba]   'food made from gàrí'   *[eba]
       [ɛgba]   'whip'   *[egba]

Archangeli & Pulleyblank (1989) conclude that harmony in Yoruba is strictly leftward. If an opaque vowel is found somewhere in the word it just divides the word into two domains. Recent studies show that the directionality of assimilation processes can be traced to asymmetries in faithfulness relations which are either phonologically or morphologically conditioned (i.e., the difference between onsets and codas with respect to neutralisation or between roots and affixes, respectively; Beckman 1998,

Lombardi 1999, Bakovic 2000, Krämer 2001a,b, and many others). Assimilation is usually attributed to a directionless agreement constraint, which demands the identity of adjacent segments or syllables with regards to a particular feature. Hence we cannot blame the edge orientation of the harmony constraint (i.e., ALIGNL(feature, word)) for this right edge disharmony.

(22)

/awo/	AGREE(ATR)	FAITH
☹ a. awo	*!	
💣 b. æwo		*
💣 c. awɔ		*

Markedness cannot be made responsible either, since we do find the same asymmetry with high vowels. If a high vowel is the penultimate vowel in the word it can be followed by a mid retracted as well as a mid advanced vowel.

(23) Yoruba high vowels
  a. ilé   'house'   ig͡bó   'forest, wood'
      idɛ   'brass'   ikɔ́   'cough'   (Baković 2000: 140)

The following tableau illustrates the dilemma of an analysis without reference to the direction of the ATR harmony.

(24)

/awo/	*[ATR]	AGREE(ATR)	IDENT
☹ a. /awo/ ~ awo	*	*	
b. /awo/ ~ æwo	**		*
💣 c. /awo/ ~ awɔ			*
d. /idɛ/ ~ ide	**		*
💣 e. /idɛ/ ~ ɪdɛ			*
☹ f. /idɛ/ ~ idɛ	*	*	

Even if we use a left-oriented alignment constraint, the analysis runs into the same dilemma here. The alignment constraint is violated likewise by the feature in the rightmost syllable that does not align with the left edge of the word in disharmonic forms.

(25)

/awo/	ALIGNL(ATR)	IDENT
☹ a. /awo/ ~ awo	*!	
b. /awo/ ~ æwo		*
💣 c. /awo/ ~ awɔ		*
d. /idɛ/ ~ ide		*
💣 e. /idɛ/ ~ ɪdɛ		*
☹ f. /idɛ/ ~ idɛ	*!	

One could rank faithfulness higher than all the other constraints but this would result in a grammar without any systematic harmony pattern at all.

Bakovic (2000) assumes that all these bisyllabic words are morphologically complex and attributes the asymmetry to the general root~affix asymmetry, since the rightmost vowel is a root vowel while the left vowel is an affix vowel. This means that when a mid vowel appears in non-final position in a word it is an affix vowel and has to agree with its neighbour in the ATR feature. If it is in the rightmost position it is a root vowel and root vowels do not have to agree with their neighbour. However, there is no other evidence for the alleged morphological complexity of these words and it is doubtful whether they really are morphologically complex.

Krämer (2001b) links the two characteristics of this language which are involved in this asymmetry, prefixation and right edge exceptionality. He proposes a right edge anchoring constraint, which anchors the right edge of roots at the right edge of words. In his definition of anchoring constraints these constraints are satisfied if the relevant grammatical category aligns with the edge referred to in surface structure and if it is faithful to its underlying feature specification. They are violated if either condition is not met. The extended anchoring constraints in Krämer's analysis explain why it is usually the same edge of the root which displays a broader range of phonological structure, that is the edge to which affixes are not attached.

To avoid unnecessary complication I will simply replace this anchoring constraint by a right edge faithfulness constraint for current purposes. The reader is referred to Krämer (2001b) for the full analysis. The constraint *ALIEN in the tableau below is a place-holder for inventory structure constraints which exclude high retracted and low advanced vowels from surfacing.

(26)

/awo/	*ALIEN	IDENTRIGHT	AGREE(ATR)	IDENT
☺ a. /awo/ ~ awo			*	
b. /awo/ ~ æwo	*!			*
☠ c. /awo/ ~ awɔ		*!		*
d. /idɛ/ ~ ide		*!		*
☠ e. /idɛ/ ~ ɪdɛ	*!			*
☺ f. /idɛ/ ~ idɛ			*	

One could object that there is still no need for right edge faithfulness in an analysis with Retracted Tongue Root as the spreading feature. If features are regarded as monovalent (see, e.g., van der Hulst & Smith 1986 on harmony and monovalent features in general, and Pulleyblank in particular on monovalent RTR in Yoruba), only the salient feature can spread. Under such an analysis advanced vowels are not active triggers of harmony. Strict leftward orientation of the spreading procedure would however predict disharmonic words with mid vowels, such as *ɛbe, which are illicit. Admission of bidirectional spreading to overcome this shortcoming excludes forms such as awo, which are well formed words in Yoruba.

Altogether, Yoruba not only displays prefixation, which could easily be accounted for as left alignment of affixes, the language has a right-left asymmetry in the feature co-occurrence restrictions on vowels, which cannot be accounted for without reference to the right edge of the word. In the analysis developed here, a faithfulness constraint referring to the right edge explained the defiant behaviour of the rightmost vowel in the word.

Yoruba displays exactly the mirror image pattern of languages with suffixation and stem controlled vowel harmony. In this account it also receives exactly the mirror image analysis. To illustrate the former claim, let me briefly summarise the harmony pattern of Turkish. Turkish has backness and roundness harmony. Furthermore the language has no prefixes at all, but a rich inventory of suffixes. Harmony almost always goes from the left to the right. Moreover, we find the two vowels o and ö in native wods only in the leftmost syllable. Elsewhere low rounded vowels do not even surface as a result of rounding and backness harmony. Here, in a suffixing language, the leftmost syllable displays a contrast which is neutralised elsewhere, while in the prefixing language Yoruba the rightmost syllable displays a contrast which is neutralised elsewhere, i.e., that between e/o and ɛ/ɔ.

2.3 Discussion

Both languages discussed in this section are exceptional in their own right and both contradict the hypothesis that grammars do not refer to the right edge. Pulaar is a suffixing language with a harmony pattern that is exclusively controlled by the rightmost vowel. Yoruba has the same harmony pattern, but the mirror image morphology, i.e., prefixation only. In neither language can a leftward spreading device account for the observed co-occurrence restrictions. These two languages give evidence for the need of a right edge faithfulness constraint. In the following section we will encounter more evidence for such right-edge faithfulness from consonantal phonology.

3. Consonants at the right edge

3.1 Final consonants in Yucatec Maya

There are a number of languages which have a phonotactic requirement on words to end in a consonant. One such language is Yucatec Maya (Straight 1976). In this language, codas are never complex and stops are optionally debuccalised in coda position.[3] Most roots and affixes are shaped in such a way that word-internally most syllables are open.

(27) Yucatec (optional) debuccalisation[4]

	full form	debuccalised form	gloss
a.	táaŋ k pak'-ik kòol	táaŋ k pak'ih kòol	'We're planting the clearing.'
	DUR 1PL plant-IMP clearing		
b.	tán a lik'-s-ik	tán a liʔsik	'You're raising it.'
	DUR 2SG rise-CAUS-IMP		

The only place where the glottal stop is found in onset position is word-initially (Straight 1976: 71f.).[5] Apart from the debuccalisation context we find the glottal stop syllable-finally only at the right edge of phrases. Straight (1976) concludes that there is no lexical glottal stop in Yucatec and that all emergences of the glottal stop are a result of neutralisation or epenthesis. Straight formulates a rule of glottal stop epenthesis which applies automatically at the right edge of phrases if no consonant is present. The epenthesis of consonants in order to provide syllable onsets is quite widespread cross-linguistically. The crucial question is why should glottal stops or fricatives be inserted at the end of words or phrases? Such an epenthesis decreases syllable-wellformedness rather than improving it.

    The solution is to treat the glottal stop in Yucatec as a boundary marker. While it occurs automatically at the left word margin as an effect of the interaction of prosodic structuring constraints and the requirement to have an onset, a specific alignment constraint is needed for the coda insertion at the right phrase edge.

(28) ALIGN Right (PhP, cons) Every phrase ends in a consonant.

With such a constraint ranking high in the Yucatec grammar every phrase has to end in a consonant. If none is present at the right edge of the last morpheme lexically the candidate with an epenthesised consonant is chosen. The activity of a similar constraint on the right edge of words is evidenced by the treatment of Spanish loan

---

[3] See Fukazawa (2001) for an optimality theoretic account of debuccalisation in Yucatec Maya.

[4] Data and glosses in (27) are taken from Straight (1976:54, 60), translinear tags are supplied by the author with the help of Poʔot Yah & Bricker (1981).

[5] Straight (1976:73) defines the crucial left edge as some intermediate morphological category between a morpheme boundary and a word boundary. The rule of glottal stop epenthesis he proposes affects this and all higher boundaries.

words. With Spanish being the official language in Mexico and Guatemala Mayan languages borrow quite a few words from Spanish. All the words which end in a vowel in the source language have a laryngeal consonant at the right edge of the word in Yucatec Maya. Most of them display the fricative. The data in (29) show this clearly. The words are taken out of a recording of a conversation and appear phrase-internally as well as phrase-finally.

(29) Spanish loans in Yucatec Maya

yan ʔòorah	'sometimes'	lìib'reh	'free/not to be paid for'
katàaroh	'cold/cough'	ʔeskwèelah	'school'
ʔàanyoʔ	'year'	ʔestèeh / ʔestèeʔ	'uh...'
tièendah	'store'	ʔaòorah	'now'

(Blair & Vermont Salas 1979)

The quality of the consonant is determined by markedness constraints. It is unclear what factor determines the choice between the glottal stop and the glottal fricative. In the illustrative tableau below I have integrated a markedness constraint against oral place specification in consonants labelled *PLACE to represent markedness. *PLACE violations of lexically present consonants are not counted to improve legibility of the tableau.

(30) Consonant epenthesis in Yucatec

		ALIGNR(wd, C)	MAX-IO	DEP-IO	*ORAL
a.	katàaro	*!			
b.	katàar		*!		
c.	katàarot			*	*!
☞ d.	katàaroh			*	

Another language requiring words to end in a consonant is Yapese (Piggott 1991). The Yapese grammar prefers the alternative strategy represented by candidate (30b). Underlyingly present final vowels are not mapped to the surface. The Yapese grammar differs from that just developed for Yucatec in the ranking of MAX-IO with respect to DEP-IO. Yapese also figures as a prominent piece of evidence in the discussion of exceptional coda consonants at the right edge of words in the next section.

3.2 Empty nuclei and a typology of right-edge consonants

Some languages show less strict restrictions on consonants at the right edge of the word than on codas elsewhere in the word. Piggott (1999) examines a range of such languages and develops a theory of consonant licensing to explain the differences in these patterns. Many researchers assume that exceptional consonants at the right edge of words have onset status (Giegerich 1985, Kaye, Lowenstamm & Vergnaud 1990, McCarthy & Prince 1990, Piggott 1991, 1995, 1999, Harris & Gussmann 1998, 2003).

The nucleus of the last syllable is then assumed to be unparsed or empty. If we analyse such languages as having a faithfulness constraint on the rightmost syllable position in the word, outranking the general coda condition of the respective language, there is no reason to regard these consonants as onsets. Hence, we do not have to assume contentless syllabic nuclei. The whole argument for word-final syllables with empty nuclei collapses under such an approach. The right-edge faithfulness constraint is given informally in (31).

(31) FAITHRight:
  The rightmost syllable constituent in the word is faithful to its underlying form.

The notion 'syllable constituent' refers to either onset, coda or nucleus without speci-fying these. Reference to segments (i.e., consonants) alone is not appropriate as will be shown by the evidence from Diola Fogni below, which displays complex codas at the right edge of words but nowhere else.

 Onset~coda asymmetries are analysed as an interaction of positional faithfulness, markedness, and general faithfulness by most researchers within OT (Beckman 1998, Lombardi 1999, Grijzenhout & Krämer 2000, and many others). The reverse analysis would restrict markedness constraints to coda consonants. For instance, Itô (1986) formulated the coda condition which states that codas are not allowed to have place features.

(32) Positional Faithfulness:
  a. IDENTOnset(F): 'Onset segments and their input agree in feature F.'
  b. Coda neutralisation grammar: IDENTOnset(F) >> *F >> IDENT(F)

(33) Positional markedness:
  a. CODACOND = 'The coda cannot license place features.'
  b. Neutralisation grammar: CODACOND >> IDENT(place) >> *PLACE

Whichever approach we choose it seems to be appropriate to deconstruct restrictions on codas as a range of independent markedness constraints which can be ranked with respect to each other and other constraints as well. Opting for the positional faithful-ness approach (rather than positional markedness), one needs the general markedness constraints in (34) to play their parts in cross-linguistic patterns of coda neutralisation.

(34) Markedness constraints on consonants
  a. NOCODA 'Syllables do not end in a consonant.'
  b. *COMPLEX 'Syllables do not have complex onsets or codas.'
  c. VOP 'Voiced Obstruents are prohibited.'
  d. *ORAL 'Oral consonants are prohibited.'
  e. *NONSONORANT 'Nonsonorant consonants are prohibited.'
  f. *STOP 'Oral stops are prohibited.'
  g. *PLACE 'Consonants do not have a place feature on their own.'

Ranking these constraints with respect to general faithfulness but always below faithfulness to onsets results in patterns of languages without codas, languages with simplex codas only, final devoicing, exclusively nasal codas, codas which can only be either fricatives or sonorants, debuccalisation and place assimilation. These are the scenarios to be examined in the following. The interesting thing to see is always how the last consonant in the word behaves and whether we can account for this behaviour by ranking the right-edge faithfulness constraint somewhere between or above the markedness constraints in the respective hierarchy.

Yapese (Jensen 1977, op. cit. Piggott 1999) does not allow coda consonants word-internally. In the word-final codas, however, the full range of consonants is attested. (35) shows some typical Yapese words illustrating the above generalisation.

(35) Yapese

garik	'jellyfish'	ruɡoːd	'woman'
faraf	'floor'	bureːy	'hillside'
magad	'container'	toːtuːl	'bark'
paːlog	'far'	geːθiːθ	'living room' (Piggott 1999: 146)

In the current approach the ranking of FAITHRight above the constraint against codas fully explains this extraordinary restriction of codas to the right edge of the word.

(36) Yapese: FAITHR >> NOCODA >> FAITH

The tableau in (37) evaluates a hypothetical input with a word-medial consonant cluster.

(37) Hypothetical word-internal consonant cluster in Yapese

/gaprik/	FAITHR	NOCODA	FAITH
a. .gap.rik.		**!	
b. .ga.ri.	*!		**
c. .gap.ri.	*!	*	*
☞ d. .ga.rik.		*	*

Right-edge faithfulness is not violated by non-parsing of the medial consonant. In satisfaction of the next lower ranked constraint, which does not tolerate codas the medial consonant is not mapped to the surface form. The final consonant cannot be skipped because this would violate FAITHR.

As mentioned above consonants are obligatory at the right edge of the word in Yapese. Hence, an analysis with an alignment constraint demanding a consonant at the right edge of the word would be appropriate as well. This, however, does not make any prediction about the quality of these consonants. They could equally well be featureless laryngeal stops.

In Eastern Ojibwa (Bloomfield 1957, Piggott 1999) we find no oral stops in coda position (38). The word-internal coda is reserved for nasals (38a) and fricatives (38b). Nevertheless, word-final codas contain oral stops, just like onsets do (38c, right column).

(38) Eastern Ojibwa
a.	ombibideː	'it flies up'	b.	biːskaːbiː	'he returns'
	mindidido	'he is big'		waːbiška:	'it is white'
	baŋgisin	'it falls'		moːškineː	'it is full'
	gaːnǰibin	'push someone'		ašpaː	'it is high'
c.	aːgam	'snowshoe'		nindib	'my head'
	wiːgiwaːm	'house'		nizid	'my foot'
	waːbimin	'apple'		askig	'seal'
	miːgwaːn	'feather'		ninik	'my arm'
	neːgaw	'sand'		waːboːz	'rabbit'
	omoːday	'bottle'		wiːyaːs	'meat'

(Piggott 1999: 146)

The grammar for Ojibwa is slightly more complex than the sketch needed for Yapese. To cover the asymmetry between codas and onsets, we have to consider faithfulness of onsets as well as general faithfulness. Oral stops are excluded from coda positions by a ranking of the markedness constraint *Stop between onset faithfulness and general faithfulness. The final coda consonants are exempted from this neutralisation if right-edge faithfulness is ranked on a par with onset faithfulness.

(39) Eastern Ojibwa: FAITHR, FAITHONSET >> *STOP >> FAITH >> NOCODA

The tableau in (40) shows the fate of a potential word-medial preconsonantal consonant and of a word-final consonant. The grammar chooses those candidates which optimise performance on markedness by not parsing the medial consonant at all or not parsing it as an oral stop. Candidates which optimise performance on markedness by not faithfully mapping the final consonant are judged as nonoptimal since they violate highly ranking right-edge faithfulness.

(40)

	/nikzid/	FAITHONSET	FAITHR	*STOP	FAITH	NOCODA
a.	nikzid			**!		**
b.	nikizid			**!	*	*
☞ c.	ninzid			*	*	**
☞ d.	niszid			*	*	**
☞ e.	nizid			*	*	**
f.	nizin		*!		**	
g.	nizi		*!		**	

There is one characteristics of Ojibwa which casts serious doubt on an analysis with final onsets. The dorsal nasal cannot occur in onset position, but it surfaces at the right edge of words, as well as in other codas. Accordingly, Piggott analyses the final consonants in Ojibwa as codas as well.

(41) Dorsal nasals in Ojibwa
    a.   bizindaŋ   '(that) s/he listens'
    b.   baŋgisin   'it falls'   (Piggott 1999: 155)

In line with cross-linguistic observations on the occurrence of the dorsal nasal we can posit a markedness constraint on onsets, which bans ŋ from the left edge of syllables, $*_\sigma(\eta$, and insert this constraint on top of the Ojibwa hierarchy.

   A language with a very similar pattern is Diola Fogni (Sapir 1965, Piggott 1999). However, the condition on codas is slightly different in Diola Fogni. The language allows only nasals and other sonorants in word-internal coda position (42a). Word-final consonants can be nonsonorants as well (42b). Moreover, codas have to be monosegmental – except in word-final position, where nasal plus obstruent sequences are allowed (42c).

(42) Diola Fogni
    a.   nimammaŋ   'I want'   b.   nikɔkɔb   'I waited'
        ninennen   'I placed'   ijaut   'I did not come'
        kundon   'large rat'   kuɲilak   'children'
        salte   'be dirty'   nalanlan   'he returned'

    c.   famb   'annoy'
        kaband   'shoulder'
        bunt   'lie'
        kaŋg   'be furthest away'   (Piggott 1999: 146f.)

Piggott observes that these word-final consonant sequences look exactly like the word-internal coda-onset sequences and concludes that this is evidence for the onset status of the last consonant. Since these clusters always show a sharp decline in sonor-

ity from left to right, they resemble typical complex codas in other languages. In the current approach the pattern is easily derived by placing the right edge faithfulness constraint above the constraint against complexity of syllabic constituents. Interestingly, the right edge faithfulness constraint has to outrank onset faithfulness now. Onsets are not complex in Diola Fogni. Thus, faithfulness to onsets has to rank below the anti-complexity constraint *COMPLEX.[6] By transitivity of ranking, right-edge faithfulness ranks higher than faithfulness to onsets. In an approach with freely rankable constraints this is exactly what one would expect.

(43)   a. Diola Fogni I:
              FAITHR >> *PLACE, *NONSONORANT >> FAITH

     b. Diola Fogny II:
     FAITHR >> *COMPLEX >> FAITHOnset >> *PLACE, *NONSON >> FAITH

A potential underlying form with a complex onset, a word-medial nonsonorant coda consonant with its own place feature and a complex final coda. Only the final coda survives under this ranking.

(44) The faith of potential codas in Diola Fogni

/ krakband/	FAITH R	*COMPL	FAITH ONS	*PLACE	*NONSON	FAITH
a. kaba	*!*			**	**	***
b. kaban	*!			***	**	**
c. kraband		**!		***	***	*
d. krakband		**!		****	****	
☞ e. kamband		*		***	***	*
☞ f. kaband		*		***	***	*

A last piece of evidence for the independent existence of a right-edge faithfulness constraint alongside faithfulness of onsets is provided by Lardil. Lardil allows only sonorants in coda position word-internally. Nasals are always homorganic with the following onset consonant. There is an additional restriction which demands that codas are always more sonorous than following onsets. Word-final codas, however, can be stops as well. There is one restriction on these word-final codas. They can only be taken from the set of coronal consonants. The only coronals which do not appear in final position are lamino-dentals. In the following analysis I will not go into the latter aspect and to focus on the current argument I will not explicitly account for the sonority sequencing restriction.

---

[6] One could argue, however, that there are two distinct anti-complexity constraints, one referring to onsets, one to codas. A closer look at coda~onset asymmetries has to reveal whether this is the case or whether asymmetries can all be derived from the generally assumed positional asymmetry in faithfulness constraints.

(45) Lardil

a.	kantu	'blood'	b.	kentapal	'dugong'
	kumpu	'anus'		keṭar	'river'
	wuŋkunu	'oyster'		miyaṛ	'spear'
	kaṇṭa	'grass'		yaraman	'horse'
	rilta	'neck'		maaṇ	'spear'
	wanka	'arm'		ŋampit	'humpy'

(Piggott 1999: 153f.)

In connection with the ban on dorsals and labials from final position one has to note that the language has no laryngeals at all, but a very large set of coronal consonants. In the absence of laryngeals we can conclude that coronal is the least marked place of articulation in Lardil. We can thus decompose the *PLACE constraint into a sub-hierarchy as proposed by Prince & Smolensky (1993), Lombardi (1997, 2001), Ortmann (1999), Krämer (in press) and others.

(46) *LAB/DORS >> *COR

Onset faithfulness has to outrank both markedness constraints against place features, since we find labials as well as dorsals in addition to coronals in onsets. We find coronals in coda position followed by a consonant with a different place of articulation, but we do not find labials or dorsals in coda position when not followed by a labial or dorsal consonant. Hence FAITHR and general faithfulnes have to rank between the markedness constraints against place features.

Furthermore we find only sonorants in coda position within the word, while the word-final coda consonant can also be a stop. This motivates the ranking of the markedness constraint against nonsonorants below FAITHR and above general faithfulness. The absence of complex onsets as well as codas motivates a ranking of *COMPLEX at the top of the hierarchy. With this last ranking argument we have the complete hierarchy in place. The ranking of FAITHOns above FAITHR follows from the independent rankings of each constraint with respect to *LAB/DORS. The ranking of FAITHR above general faithfulness is established via the ranking of each constraint with respect to *NONSONORANT.

(47) Lardil grammar:
  *COMPL >> FAITHOns >> *LAB/DORS >> FAITHR >> *NONSON >> FAITH >> *COR

The working of this grammar is illustrated by the evaluation of a hypothetical underlying form which is more complex than Lardil surface forms are allowed to be in tableau (48).

(48)

/kramtup/	*COMPL	FAITHOns	*LAB/DORS	FAITHR	*NONSON	FAITH	*COR
a.　kramtump	*!*		***		***		**
b.　kramtup	*!		***	*	***	*	**
c.　kamtup		*	**!*	*	***	**	*
d.　kantup		*	**!	*	***	***	*
☞ e.　kantut		*	*	**	***	****	**

Piggott briefly notes French as additional evidence to his final onset account for languages such as Yapese or Ojibwa, since many of the stop-sonorant clusters observed in French, as in *litr* 'litre', *tabl* 'table' etc. resemble onsets. However, if we look at English we see that English allows something in these clusters which it does not tolerate in onsets at all, i.e., the sequence 'tl', as in the word 'bottle'. Thus, in these cases an analysis as a syllable which allows a sonorant consonant in nucleus position is more appropriate than an analysis as a complex onset plus an unexpressed nucleus.

From cases like Lardil and Diola Fogni in particular it is only a step to an analysis of exceptional word-final consonant clusters in Cairene Arabic, as discussed in Bye & de Lacy. In Cairene Arabic we find words like *katabt* but not *tabtka*. Tautosyllabic consonant clusters are prohibited apart from the right edge. Furthermore, these tautosyllabic clusters have no decrease in sonority. An analysis thus has to rank the right-edge faithfulness constraint higher than a sonority sequencing constraint which bans sonority plateaus in onsets and codas. This markedness constraint in turn has to outrank onset faithfulness in Cairene Arabic.

4. Conclusion

In this paper I examined a range of phonological phenomena which display a right/left asymmetry. Phenomena were chosen which contradict recent and older statements about universal preferences relating to the phonological asymmetry between lexical and functional elements and the phonological asymmetry between the left and right edge of categories. First it was noted here that the cross-linguistic tendency that lexical material (i.e., roots) is less prone to neutralisation than functional material has to be regarded as a tendency rather than as a universal fact as enshrined in McCarthy & Prince's root/affix meta-ranking. Closer investigation of a language with affix controlled vowel harmony and a language with exclusive prefixation and root controlled vowel harmony revealed the need for a faithfulness constraint on the right edge of words. This challenges Bye & de Lacy's (2000) EAH and adds to Beckman's inventory of positional faithfulness constraints. With this tool at hand the door was open for a new analysis of exceptional consonants at the right word margin.

Piggott (1999) challenges Kaye, Lowenstamm & Vergnaud's (1990) theory of strict CV syllable structure by saying that while some final consonants are onsets some have to be analysed as codas. The current account goes beyond this by obviating the need to assume an extra syllable position with an unexpressed vowel at all. It should be noted that though the postvocalic consonants are assumed to be syllabified together with the preceding vowel, there is no reference to anything like a coda in the analysis at all, i.e. in any of the constraints (apart from NoCoda apparently). This suggests that indeed the coda as a linguistic category is not needed. However, a full examination of this matter would need to take into consideration languages with large consonant clusters within words and less rich structures at the margins, as discussed in Kaye, Lowenstamm & Vergnaud.

As noted earlier, Bye & de Lacy's EAH cannot be upheld in the face of the above phenomena. An explanation for the left-right asymmetry in phonology and morphology therefore has to be sought outside Universal Grammar, for instance in the general cognitive principle of information structuring given in (5), repeated here as (49).

(49) Lexical Privilege Hypothesis:
    Contents is more important than structural information.

If we compare linguistic asymmetries with the organisation of information in texts, for instance, such as newspaper articles, scientific articles, etc., we find a similar asymmetry there. The most important information is usually given in the first paragraphs of a text or in the preceding abstract (the "W5" – "who did what, where, when, and why"). However, not all texts are consistently organised like this. In crime stories, the most important information is often withheld until you reach the last page. Only then will you know who committed the crime. In this metaphor, languages like Yoruba are like crime stories, while suffixing languages are like newspaper articles with respect to the organisation of information. In Yoruba the most informative place in the word is the last syllable, while in suffixing languages the last syllable only contributes minor information (i.e., grammatical information) that enhances understanding.

References

Archangeli, Diana & Douglas Pulleyblank (1989). Yoruba Vowel Harmony. *Linguistic Inquiry*. 173-217.

Baković, Eric (2000). *Harmony, Dominance and Control*. Unpublished PhD dissertation. Rutgers University, New Brunswick.

Beckman, Jill N. (1998). *Positional Faithfulness*. PhD dissertation. University of Massachusetts, Amherst.

Blair, Robert W. & Refugio Vermont Salas (1979). *Spoken Yucatec Maya*. Columbia, Missouri: Lucas Brothers Publishers.

Bloomfield, Leonard (1957). *Eastern Ojibwa*. Ann Arbor: University of Michigan Press.

Breedveld, J. O. (1995). *Form and meaning in Fulfulde. A morphological study of Maasinankoore*. Leiden: CNWS Publications.

Bye, Patrick & Paul de Lacy (2000). Edge Asymmetries in Phonology and Morphology. *NELS* 30. 121-135.

Casali, R. (1997) Vowel elision in hiatus contexts: which vowel goes? *Language* 73. 493-533.

Fukazawa, Haruka (2001). Local Conjunction and Extending Sympathy Theory: OCP Effects in Yucatec Maya. In Linda Lombardi (ed.) *Segmental Phonology in Optimality Theory. Constraints and Representations*. Cambridge University Press. 231-260.

Greenberg, Joseph H. (1957) Order of Affixing: A Study in General Linguistics. In Joseph Greenberg (ed.) *Essays in Linguistics*. New York: Werner-Green Foundation. 86-94.

Grijzenhout, Janet & Krämer, Martin (2000). "Final devoicing and voicing assimilation in Dutch derivation and cliticization." In *Lexicon in Focus*. [Studia Grammatica 45.] Barbara Stiebels & Dieter Wunderlich (eds.), 55-82. Berlin: Akademie-Verlag.

Harris, John & Edmund Gussmann (1998). Final codas: why the west was wrong. In E. Cyran (ed.) *Structure and interpretation: studies in phonology*. Lublin: Folium. 139-162.

— (2003). *Word-final onsets*. Ms. University College London, University of Gdansk.

Hayes, Bruce (1985). Iambic and trochaic rhythm in stress rules. In M. Niepokuj, M. VanClay, V. Nikiforidou & D. Jeder (eds.) *Proceedings of BLS 11: Parasession on Poetics, Metrics, and Prosody*. Berkeley: Berkelez Linguistics Society. 429-446.

— (1995). *Metrical Stress Theory: Principles and Case Studies*. Chicago: The University of Chicago Press.

Hulst, Harry van der & Norval Smith (1986). On Neutral Vowels. In Koen Bogers, Harry van der Hulst & Maarten Mous (eds.) *The Representation of Suprasegmentals*. Dordrecht: Foris. 233-279.

Hulst, Harry van der & Jeroen van de Weijer (1995) Vowel Harmony. In John A. Goldsmith (ed.) *The Handbook of Phonological Theory*. Cambridge, MA: Blackwell. 495-534.

Itô, Junko (1986). *Syllable Theory in Prosodic Phonology*. PhD dissertation, University of Massachusetts, Amherst.

Kaye, Jonathan D., Jean Lowenstamm & Jean-Roger Vergnaud (1990). Constituent structure and government in phonology. *Phonology* 7. 193-231.

Kirchner, Robert (1993). *Turkish Vowel Harmony and Disharmony: An Optimality Theoretic Account.* Paper presented at Rutgers Optimality Workshop I (ROW I), October 22.

Krämer, Martin (2001a) Yucatec Maya vowel alternations – Harmony as Syntagmatic Identity. *Zeitschrift für Sprachwissenschaft* 20. 175-217.

— (2001b) Vowel Harmony and Correspondence Theory. PhD thesis. Heinrich-Heine-Universität Düsseldorf and University of Ulster.

Lamontagne, Greg & Keren Rice (1995). A Correspondence Account of Coalescence. *University of Massachusetts Occasional Papers in Linguistics* 18. 211-224.

Lombardi, Linda (1997). Coronal Epenthesis and Markedness. *University of Maryland Working Papers in Linguistics* 5. 156-175.

— (1999). Positional Faithfulness and Voicing Assimilation in Optimality Theory. *Natural Language and Linguistic Theory* 17: 267-302.

— (2001). Why Place and Voice are Different. In Linda Lombardi (ed.) *Segmental Phonology in Optimality Theory. Constraints and Representations*. Cambridge University Press. 13-45.

McCarthy, John J. & Alan S. Prince (1993). Generalized Alignment. In Geert Booij & Jaap van Marle: *Yearbook of Morphology*. Dordrecht: Kluwer. 79-153.

— (1995). Faithfulness and Reduplicative Identity. In Jill N. Beckman, Laura Walsh Dickey & Suzanne Urbanczyk (eds.). *University of Massachusetts Occasional Papers in Linguistics*. 18: 249-384.

Noske, Manuela (2000). [ATR] Harmony In Turkana: A Case Of Faith Suffix >> Faith Root. *Natural Language & Linguistic Theory* **18**, 771-812.

Paradis, Carole (1992). *Lexical Phonology and Morphology: The Nominal Classes in Fula*. New York, London: Garland.

Pensalfini, Rob (2002). Vowel harmony in Jingulu. *Lingua* 112: 561-586.

Piggott, Glyne L. (1991). Apocope and the licensing of empty-headed syllables. *The Linguistic Review* 8. 287-318.

— (1999). At the right edge of words. *The Linguistic Review* 16. 143-185.

Poʔot Yah, Eleuterio & Victoria R. Bricker (1981). *Los verbos del Maya Yucateco*. Tulane University: Center for Latin American Studies.

Pulleyblank, Douglas (1996). Neutral Vowels in Optimality Theory: A Comparison of Yoruba and Wolof. *Canadian Journal of Linguistics/Revue canadienne de linguistique* 41(4). 295-347.

Revithiadou, Anthi (1998). *Headmost accent wins. Head Dominance and Ideal Prosodic Form in Lexical Accent Systems*. The Hague: Holland Academic Graphics.

Sapir, Edward (1949). *Language. An introduction to the study of speech*. New York: Harcourt, Brace & World.

Sapir, J. David (1965). *A Grammar of Diola-Fogni*. Cambridge: Cambridge University Press.

Smolensky, Paul (1993). Harmony, markedness, and phonological activity. Paper presented at Rutgers Optimality Workshop-1 at Rutgers University: New Brunswick, NJ, October 1993.

Straight, H. Stephen (1976). *The Acquisition of Maya Phonology – Variation in Yucatec Child Language*. New York, London: Garland.

Trubetzkoy, Nikolaj S. (1939/1985). *Grundzüge der Phonologie*. 2nd ed. Göttingen: Vandenhoeck und Ruprecht.

Ussishkin, Adam P. (2000). *The emergence of fixed prosody*. PhD thesis. University of California, Santa Cruz.