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An RcvP analysis of vowel harmony in Yoruba

Harry van der Hulst

1. Introduction[1]

In this article, I discuss several analyses of vowel harmony in various varieties of Yoruba (Niger-Kordofanian, Niger-Congo, Kwa). My primary goal is to present an analysis that uses the framework of Radical cv Phonology (RcvP) proposed in van der Hulst (2005, 2012, ms. *a*, *b*). My goal will be to demonstrate how the facts of various Yoruba dialects can be accounted for in this model which uses unary elements and dependency relations, among others, with regard to the issue of transparent and opaque vowels. I will show that the proposed analysis is compatible with the claim that vowel harmony relations are *local*. I will also consider two types of analyses that use binary features, one using Radical Underspecification Theory (Archangeli and Pulleyblank 1989), which comes quite close to the RcvP analysis, and one using fully specified representations (Nevins 2010), which is quite different and entails the claim that vowel harmony can seek out only feature values that are contrastive or all feature values (both contrastive and redundant) (or even only marked values). In Nevins (2010), vowel harmony is no longer captured in terms of a local relationship.

2. Standard Yoruba in Radical Underspecification Theory

Here I follow Archangeli and Pulleyblank (1989) and Orie (2001, 2003) for the basic facts. Yoruba has a seven vowel system:[2]

(1)

i		u	[+ATR]
e		o	[+ATR]
ɛ		ɔ	[–ATR]
	a		[–ATR]

[1] Thanks to Beata Moskal and Olanike Ola Orie for comments on this paper. I would like to especially thank Olanike for her help in clarifying the patterns, answering my queries and supplying additional data.

[2] Here I do not discuss nasal vowels which pose extra challenges; see Orie (2003: 7, fn 10).

This system has two important constraints which rule out high retracted and low advanced vowels, respectively:

(2)

Constraints

a. *[+high, –ATR]
b. *[+low, +ATR]

High mid and low mid vowels do not co-occur (see 6), but in addition /e/ and /o/ do not occur to the left of /a/. Furthermore, /ɛ/ and /ɔ/ can only precede high vowels if the latter are word final. Thus, the two sequences in (3) are ill-formed:

(3)

a. *... e/o/ – a (see 5b below)
b. *... ɛ/ɔ – i/u – V (see 7, 8 below)

Both patterns, as will be evident, demonstrate a leftward directionality, involving /a/ and /i, u/ imposing [–ATR] and [+ATR] to the left, respectively.

The following data, taken from Archangeli and Pulleyblank's article (henceforth AP) and Orie (2001, 2003, pc.[3]), demonstrate the relevant patterns within monomorphemic stems (tone marks have been omitted).[4] Harmony in derived forms will be discussed in Section 7.

(4)

	a. i-initial[5]		b. i-final		c. u-final		(AP 4)
i	igi	'tree'	igi	'tree'	iṣu	'yam'	
e	ile	'house'	ebi	'hunger'	eku	'bush rat'	
e	ilɛ	'land'	ɛbi	'guilt'	ɛwu	'clothing'	
a	ika	'okra'	ami	'sign'	arun	'five'	
o	itɔ	'saliva'	ɔkin	'egret'	ɔrun	'heaven'	
o	igo	'bottle'	ori	'head'	oju	'eye'	
u	iṣu	'yam'	—		—		

[3] I am grateful to Olanike Ola Orie for supplying me with additional data and answering my questions regarding data (which are indicated with 'OO').
[4] Before reading the remainder of this article, the reader is invited to formulate an analysis that accounts for these data.
[5] There are no /u/-initial roots in Standard Yoruba.

(5)

	a. a-initial		b. a-final		(AP 6)
i	adi	'palm nut oil'	ila	'okra'	
e	ate	'hat'	—		
e	ajɛ	'witch'	ɛpa	'groundnut'	
a	ara	'body'	ara	'body'	
o	aṣɔ	'cloth'	ɔja	'market'	
o	awo	'plate'	—		
u	atu	'type of dress'	—		

(6)

	e/o		ɛ/ɔ		(AP 8)
e-initial	ebe	'heap for yams'	—		
	epo	'oil'	—		
o-initial	ole	'thief'	—		
	owo	'money'	—		
ɛ-initial	—		ɛsɛ	'foot'	
	—		ɛkɔ	'pap'	
ɔ-initial	—		ɔbɛ	'soup'	
	—		ɔkɔ	'vehicle'	

(7)

a. elubɔ 'yam flour' (AP 19)
b. owurɔ 'morning'
c. okurɔ 'palm kernel'
d. orukɔ 'name'
e. erupɛ 'earth'
f. ewurɛ 'goat'
g. odidɛ 'parrot'

(8)

a. ebute 'habour' (OO)
b. ewuro 'bitter leaf'
c. oguro 'upright'
d. ofifo 'null'

(9)

a. aburo	'younger sibling'		d. abiya	'armpit' (AP 22)	
b. adugbo	'neighborhood'		e. agutan	'sheep'	
c. atike	'makeup powder'		f. akurɔ	'a type of farmland'	

(10)

g.	igbakɔ	'wooden saucer'	h. igbado	'corn' (OO)
i.	ilawɛ	'place name'	j. aṣaro	'yam porridge'

(11)

a.	ɔfafa	'tree bear' (OO)
b.	ɔfada	'place name'

AP, using Radical Underspecification Theory (RUT, Kiparsky 1982, Archangeli 1984), show that the data can be straightforwardly analyzed if roots with [–ATR] mid vowels contain a *floating* [–ATR] feature which associates from right-to-left to non-high vowels, [+ATR] being the default value. /i/ and /u/ are opaque as they lack an [–ATR] counterpart (see 2a). Therefore the [–ATR] feature is *incompatible* with these vowels. Given that the floating [–ATR] associates from right-to-left, vowels to the left of non-final /i/ and /u/ will not get associated to it, because the high vowels block it. Therefore such vowels are [+ATR] by default. However, if /i/ and /u/ are final, the floating feature can dock on the vowel *preceding* them (see 4b and 4c). The [–ATR] specification for /a/ is predictable and thus lexically unspecified, but AP assume a convention which will assign this value prior to the association and spreading of the floating [–ATR]. Therefore mid vowels occurring to the left of /a/ end up being [–ATR]; see (5b).

Let us see how the different vowels behave with respect to harmony:

(12)

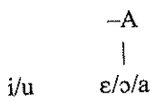
/i/	/u/	not accessible for [–ATR]; [+ATR] by default
/e/	/o/	[+ATR] by default
/ɛ/	/ɔ/	[–ATR] by association to floating [–ATR]
/a/		predictably [–ATR], *filled in before spreading*

In (13), a representative set of the possible relevant sequences of vowels, as they are specified prior to spreading, are schematically represented. At this point, floating [–ATR] has been docked on the rightmost eligible vowel and /a/ has been specified as [–ATR]. The arrow represents spreading:

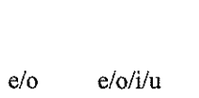
(13)

a.

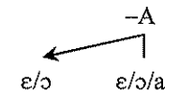
b.



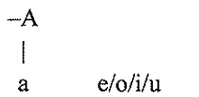
c.



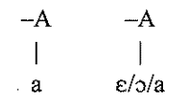
d.



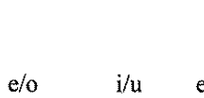
e.



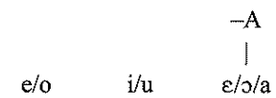
f.



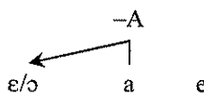
g.



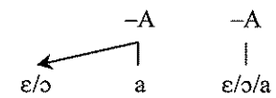
h.



i.



j.



The non-occurrence of /ɛ, ɔ/ to the left of non-final /i, u/ (cf. 13h) is explained because [–ATR] cannot spread across two high vowels which therefore act as opaque, assuming that association cannot be discontinuous. In other words, for AP, the vowel harmony relation is local. Note that to avoid the sequence [ɛ/ɔ – i/u/ – ɛ/ɔ/a] it is crucial that AP assume that the feature [–ATR] is a floating feature and as such first associated to the rightmost eligible vowel (in this case the final vowel), spreading leftward from there, which in this case is not possible because /i/ and /u/ are not susceptible to receiving [–ATR] given (2a). This analysis explains why in the case of a sequence of two mid vowels the harmony is apparently bidirectional, whereas the mandatory occurrence of retracted vowels next to /a/ has a leftward orientation.

Given the adopted framework, this analysis is straightforward and elegant. In fact, I see no ground for questioning it, except for one point made below. My reasons for exploring a different analysis is simply that I am adopting a different model which, in some sense, is a radical version of Radical Underspecification Theory, viz., a model in which features are systematically *single-valued*. The arguments in favour of this model (which is based on the seminal work in Anderson and Ewen 1987) have been discussed elsewhere (see van der Hulst 2005, 2012, ms. *a*, *b*).[6]

[6] I must add that the Yoruba data (or systems based on tongue root harmony in general) are not the best to argue in favor of RcvP over RUT because, in the case at hand, RcvP has unary analogues to both [+ATR] and [–ATR] (the elements |∀| and |A|, respectively).

My only point of criticism is that it is not clear why Standard Yoruba could not also be analyzed as a [+ATR] system, with the added *rule* that vowels to the left of a *non-final* /i/ and /u/ must be advanced. The fact is that the two sequential constraints in (2) can point in two directions. If the spreading value is taken to be [–ATR], then /i/ and /u/ are supposed to be opaque whereas we expect /a/ to be transparent. This is so because we expect vowels that are *compatible* with the spreading value to be transparent and vowels that are *incompatible* with the spreading value to be opaque. This, at least, is what was proposed in van der Hulst and Smith (1986) and it seems to me that the AP model is fully compatible with this proposal. Given that [–ATR] is the spreading value, /i/ and /u/ are expected to be opaque because they are incompatible with this value, and they are. However, /a/ is not transparent which means that the constraint in (3a) must follow from *an extra statement*. This extra statement is 'well hidden' in AP's analysis. They assume that /a/ gets its predictable [–ATR] specification *before* spreading so that the leftward spreading of that feature gets a 'free ride' on the leftward association of the floating [–ATR] feature. However, suppose we take the spreading feature to be [+ATR]. Then /a/ is expected to be opaque and /i, u/ are expected to be transparent. So, in this analysis, the opaque behaviour of /a/ is precisely what we expect. But now the high vowels which require vowels to the left to be [ATR] (which implies that, contrary to expectation, they are not transparent) require an extra treatment. Thus, it would have to be said that the predictable [+ATR] for /i/ and /u/ is filled in prior to spreading so that its leftward spreading can get a free ride on the leftward association of the floating [+ATR]. Schematically:[7]

(14)

Spreading feature:	[–ATR]	[+ATR]
a. *...e/o/ – a	unexpected	expected
b. *... ɛ/ɔ – i/u – V	expected	unexpected

Hence, in either type of analysis there is an unexpected pattern that needs to be accounted for by a special statement. In the RUT model, the unexpected behaviour in both analyses results from assuming that a predictable value is assigned prior to spreading. It is not clear to me why AP prefer the [–ATR] analysis over the [+ATR] analysis, but, in any event, both analyses would allow us to see vowel harmony relation as a local relationship.

[7] The reasons that Archangeli and Pulleyblank cannot adopt this analysis is because they assume that the vowel /i/ is fully unspecified which, necessarily, makes [+ATR] the default value.

There is, in fact, a reason for preferring the [+ATR] analysis which is that in the Ife dialect (which we discuss in Section 5) we *must* choose this value as the active one. If we adopt a [+ATR] analysis for both the standard and the Ifɛ dialect, the difference between them simply lies in the behaviour of /i/ and /u/ which are unexpectedly opaque in standard Yoruba, whereas they are expectedly transparent in Ifɛ Yoruba. In both dialects the opaque behaviour of /a/ would be expected. There is a further more technical argument: if [+ATR] is active, we can say that it must be associated to the *final* vowel (rather than to the rightmost eligible vowel). If this vowel is /a/, the floating feature cannot associate to it which means that it cannot associate at all. In this way we can say that the 'association convention' (see AP 15) can only seek out strictly peripheral targets. (I will show that when the RUT analysis is 'translated' into a unary analysis, the choice of ATR being active then is compatible with the notion of 'positional licensing' (which is the analogue of AP's 'association convention')).

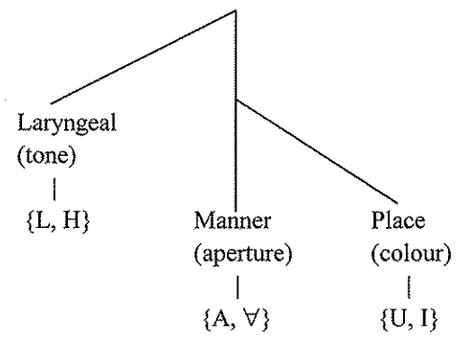
In the next two sections, I will show how the same data can be analyzed in a model proposed in van der Hulst (2012) which adopts four unary elements and dependency relations between these elements. Section 3 will briefly outline the model and Section 4 will apply it to the Standard Yoruba facts.

3. The RcvP model[8]

3.1. Gestures, elements and headedness

In RcvP (van der Hulst 2005), each segment has a tripartite structure consisting of the Laryngeal, Manner and Place gesture, as in (15). Within each gesture, we find precisely two elements.

(15)



[8] This section is based on van der Hulst (2011; ms. *a*) where the model is discussed in greater detail.

The six elements in (15) can in fact be replaced by just two, viz., |C| and |V|, as in (16) (hence the name *Radical* cv Phonology).

(16)

	Element names	RcvP coding
Manner	A ∀	V C
Place	U I	V C
Laryngeal	L H	V C

This reduction is possible because each gesture contains exactly two elements. This allows us to say that the element labels |A|, |U| and |L|, because they occur under different gestures, are paradigmatically speaking in complementary distribution, and so can be reduced to one and the same element, viz. |V|. The same holds for |∀|, |I| and |H|, which can be reduced to |C|. Complementary distribution is a familiar criterion used to reduce allophones to phonemes (where allophones are in complementary distribution in a syntagmatic sense). However, the same criterion can be applied to elements, provided that the elements that we reduce to |C| or |V| have something in common. In RcvP, the claim is that in each gesture, |A|, |U| and |L| represent vowel- or rhyme-oriented choices, and so reduce to |V|, while |∀|, |I| and |H| represent consonant- or onset-oriented choices, and so reduce to |C|. However, for practical purposes, I will normally use the element labels |A, U, L,∀, I, H| so as to avoid cumbersome expressions such as '|Place: V|' (instead of '|A|').

Gestures may contain a single element or a combination of elements. In the latter case, the elements enter into a head-dependency relation, such that one element is the head and the other the dependent. Headedness will be graphically indicated by underlining.

Following Kaye, Lowenstamm and Vergnaud (1985), I assume that an element in dependent position corresponds to a single phonetic attribute while an element in head position (without an accompanying dependent) denotes a complete segment – an idea that is also implicit in Dependency Phonology (Anderson and Ewen 1987). For example, in isolation the head element |U| denotes back rounded /u/, while dependent |U| denotes labiality (e.g., rounding), as in /y/.[9] If the element |U| occurs with a dependent |I|, the result is a 'fronted /u/', e.g., a kind of 'central' rounded vowel. I will return to the interpretation of such structures shortly.

[9] For ease of exposition I refer to phonemic entities (hence the use of slant lines), although it is important to bear in mind that IPA symbols represent approximate phonetic values. A notation such as /u/ is shorthand for the corresponding elemental structure, which represents a cognitive phonological entity that plays a contrastive role in a particular language.

The idea of having different (but related) phonetic interpretations for elements is referred to as the 'dual interpretation' of elements (cf. van der Hulst 1988*a*). Consider for example (17):

(17)

The dual interpretation of A *and* ∀[10]

	Head	Dependent
A	/a/	'low (or retracted)'
∀	/i̱/	'high (or rather ATR; cf. below)'

Combinations of |A| and |∀| denote intermediate aperture degrees and correspond to intermediate central vowels, as in (18):

(18)

A	A∀	∀A	∀	
/a/	/ɜ/	/ə/	/i̱/	(central)
	/ʌ/	/ɤ/	/ɯ/	(back unrounded)

In the case of a three-way distinction in aperture, there is a choice of IPA symbols provided we make the (not uncommon) assumption that languages never employ a phonological contrast between central and back unrounded vowels.

All vowels considered so far are 'manner-only' or 'colourless' vowels. Let us therefore now consider the 'colour' elements, viz., |U| and |I|. These have the dual interpretations in (19):

(19)

Interpretation of U *and* I

	Head	Dependent
U	/u/	'round'
I	/i/	'front'

Adopting (for convenience) the 'autosegmental line-notation' that was proposed in Kaye, Lowenstamm and Vergnaud (1985), in which headedness is indicated by underlining, yields the following representations for the four front unrounded vowels:

[10] Here I use articulatory labels for the phonetic interpretation of elements. Elements are also associated with an acoustic interpretation.

(20)

/æ/	/ɛ/	/e/	/i/
	∀	∀	∀
A	A	A	
I	I	I	I[11]

The next question that must be addressed concerns the interpretation of combinations of |U| and |I|. Consider (21), where |U| and |I| are combined with the aperture element |∀|:

(21)

/u/	/ʉ/	/y/	/i/
∀	∀	∀	∀
U	U	U	
	I	I	I

Both Anderson and Ewen (1987) and Kaye, Lowenstamm and Vergnaud (1985) stipulate that there is no difference between |UI| and |UI|, which both yield a rounded front vowel. However, I assume that these combinations in fact denote two distinct vowels, which are sometimes referred to as 'out-rounded' /y/, e.g., a rounded front vowel, and 'in-rounded' /ʉ/, a fronted back-round vowel. These vowels are sometimes contrastive, for example in Swedish.

Cross-classifying aperture and colour, and allowing for both colourless and mannerless vowels, yields 25 different monophthong vowels, given in (22):

(22)

	I	**IU**	**Colourless**	**UI**	**U**
∀	i	y	ɨ ~ ɯ	ʉ	u
Mannerless	ɪ	ʏ	ə (~ schwa)		ʏ
∀A	e	ø	ɘ ~ ɤ ~ ɐ	ɵ	o
A∀	ɛ	œ	ɜ ~ ʌ	ɞ	ɔ
A	æ	ɶ	a ~ ɑ		ɒ

Each language selects a subset of these vowels by imposing combinatorial constraints, which will be exemplified below for the Yoruba system.

[11] When a gesture contains just one element, this element is the head; for simplicity sake, I do not mark this by underlining. Also note that, there is a head *per gesture*. So /e/ would have the ATR-element as the head in the manner gesture and the I-element as the head in the colour gesture.

3.2. The vowel harmony relation

In a unary system, it is impossible to say that vowel harmony is the result of 'needy', e.g., underspecified, vowels (cf. Nevins 2010), since there is no underspecification to express this 'neediness'. Nevertheless, the idea of 'neediness' is similar in spirit to the Government Phonology approach, where 'emptiness', or more specifically empty nuclei, require licensing (cf. Kaye, Lowenstamm and Vergnaud 1990). In van der Hulst (2012), I suggest that a vowel that undergoes vowel harmony possesses the harmonizing element as a *variable element*, e.g., an element which can be present only if it is licensed by a non-variable, e.g., licensed, occurrence of that same element. Thus, alternating vowels contain the harmonic element as a 'variable'; variable elements will be represented between parentheses.[12] Segmental structures that contain a variable element will be called *morphophonemes*. For example in Finnish, all vowels that are front (in stems) or *can* be front (in suffixes) are represented as *morphophonemes*:

(23)

/u/ ~ /ü/	{U(I)}
/o/ ~ /ö/	{AU(I)}
/a/ ~ /ä/	{A(I)}

Variable elements represent the neutralization of the contrast between presence and absence of an element. In a binary feature system, absence of contrast would be expressed by saying that the harmonic feature is not specified, but in the current model it is expressed in terms of a variable element which means 'E or nothing'. It must be borne in mind that the so-called zero that is used in underspecification also refers to a disjunction namely '+ or –'.

While a complete theory of licensing remains to be developed (see van der Hulst ms. *b*), van der Hulst (2012) proposes two types of licensing:[13]

(24)

a. Positional licensing

   An element X is licensed in position P (where P is the first/last syllable in domain D, where D is a Word or Stem/Root)

[12] I will refine this notion in our discussion of ATR-harmony in Yoruba.

[13] In van der Hulst (2011) positional licensing refers to 'a variable element (X)'. Here I simplify that to 'an element X'. Also, here I assume that the directionality of lateral licensing does not need to be stated. Any variable element is licensed by either a preceding or following licensed instance of the same element; see van der Hulst (ms. *b*) for further discussion of this point.

b. Lateral licensing

A variable element (X) is licensed by an adjacent occurrence of X

The crucial aspect of positional licensing is that position P licenses the presence of element E which implies that in this position we can find a *contrast* between the presence of E and its absence. In all other positions, no contrast is allowed which means that in those positions we always find (E).

If positional licensing rules alone, we find that a potential contrast is neutralized in the non-privileged position. If lateral licensing is active, we get the effect that the non-privileged positions agree with the privileged position for the element E. In other words, the fact of vowel harmony is expressed in terms of lateral licensing.

It might be asked *why* I use the notion of variable element and lateral licensing. The motivation for using the variable notation, rather than saying that vowels in non-privileged positions simply lack the element E, comes from disharmonic roots and non-alternating affix vowels. With the variable notation we can distinguish vowels that alternate from vowels that do not alternate either by always having E or never having E. Thus we can make a three-way distinction:

(25)

a.	b.	c.
(E)	E	
X	X	X

a = alternating vowel, element must be licensed to get interpreted
b = invariant E
c = invariant non-E

A disharmonic root with (for example) a front vowel preceding a back vowel (e.g., ü – o) would have the positionally licensed I-element associated to the front vowel and there would be no variable element on the back vowel. This can be illustrated with the Hungarian disharmonic root *büro* 'desk' (Hungarian has palatal harmony, e.g., harmony for the element |I|):

(26)

a.

			A
	I		
	U		U
b	ü	r	o

b.

	A			I
	U			U
k	o	sz	t	ü m

The second example illustrates an invariable occurrence of the element |I| in non-initial position. We could say that in this case the element |I| is 'lexically licensed', which essentially means that its occurrence is irregular, just like *büro* is irregular in lacking the variable (I) in non-initial position.

Affixes can also have disharmonic vowels. A suffix that is invariably back would have option (25c), whereas a suffix that is invariably front would have option (25b). Regular alternating suffixes would have option (25a). If we were to adopt a spreading (or copy) model, using unary elements, we cannot distinguish between (a) and (c).

Now, whereas vowels in harmonic affixes *de facto* alternate (which is adequately expressed by supplying its vowels with the variable element, e.g., the neutralization option), vowels in stems do not (in so-called stem or root-controlled systems). It might be said that we could therefore assume that all vowels are marked with this element as *in*variable. However, there is interesting evidence (provided in Harrison and Kaun 2001) that non-initial vowels in, for example, Turkish and Finnish are *not* invariably specified with the harmonic value. This evidence is based on certain language games. I refer to van der Hulst (ms. *b*) for discussion.

Another question that arises is whether vowels that contain the harmonic element *predictably* (such as /i/ and /e/ in Finnish which always contain the element |I|, or /i/ and /u/ in Yoruba which contain the ATR-element predictably) *must* have this element lexically (invariably in the privileged position and variably in other positions) or rather acquire it by a redundancy rule. Contrary to my discussion in van der Hulst (2012), I assume here that *all* predictable elements *are* specified, as shown in the following examples from Hungarian:

(27)

a.

			∀			∀			
		A							
			(I)			(I)			
p	a	p	i:	r	–	b	ö:	l	'of paper'

b.

∀		∀		∀			
		A					
I	>	(I)		>	(I)		
ü	v	e	g	–	b	ö:	l	'of glass'

However, since predictable elements cannot always act as licensors, I will assume that they are specified as variable which means that they cannot act as a licensor, unless they occur in a position where the element is positionally licensed (the

initial position in Hungarian) or laterally licensed as in the form *üveg-bö:l* 'of glass'. This explains why neutral vowels act as licensors when they are the only vowel(s) in the stem[14] or when preceded by a front vowel. This raises the question how this element gets interpreted if it is not positionally or laterally licensed. I will assume that a predictable element is *segmentally (or paradigmatically) licensed* due to a segmental constraint that requires its presence. Paradigmatic licensing acts intrasegmentally, predicting an element E1 on the basis of another element E2. In Hungarian every vowels that has the element |∀| must have either |I| or |U|. Elements that are only segmentally licensed fail to act as licensors, unless they occur in a position in which their I-element is positionally or laterally licensed (as well).

4. Standard Yoruba in Radical cv Phonology[15]

I will now sketch the RcvP analysis of vowel harmony in Standard Yoruba. A seven vowel system as that of Yoruba has the following representation:

(28)

a. *A 7-vowel system, fully specified*

/i/	/u/	/e/	/o/	/ɛ/	/ɔ/	/a/
∀	∀	∀	∀	∀	∀	
		A	A	A	A	A
I		I		I		
	U		U		U	

b. *Constraints*

i.	Aperture:	¬ ∅	"cannot be empty"
ii.	Colour:	¬ (I ∧ U)	"I and U do not combine"
iii.	Cross-gestural:	I v U ↔ ∀	"∀ and colour must co-occur"

Note that the property of advanced tongue root is represented by a headed ∀-element, whereas retraction is represented by a headed A-element. Since, in Section 2, I indicated that a RUT analysis which sees the feature [+ATR] as

[14] Hungarian has about 60 stems which are exceptional in taking a back vowel in the suffix; see van der Hulst (ms. *b*) for a more extensive analysis of Hungarian.

[15] The analysis that I propose here for Standard Yoruba is similar to that in Ola (1992) in seeing this as a system in which ATR is active (rather than RTR) and also in maintaining that the vowel harmony relation is local.

active is to be preferred, I will present an analysis in terms of the ATR-element being active. The analysis proceeds as follows.

In this case, harmony does not just involve the licensing of a variable element. Rather, what is variable in this case is the *headedness* of the |A∀| combination. Since mid vowels can be advanced or retracted, we will say that mid vowels in roots are specified as |A, ∀|, with no specification for headedness, *except* in the right-most vowel in which case the element |∀| can be marked as a head if the root ends in an advanced vowel. Vowel harmony is thus captured by the following two licensing constraints:

(29)

Licensing of |∀| *as a head*

a. Positional licensing: The element ∀ is licensed to be a head in the final vowel

b. Lateral licensing: The element |∀| is licensed to be a head if there is a headed |∀| adjacent to it

If |∀| is licensed in final position then all non-final positions must have |(∀)|.[16] It should be noted that this, however, does not exclude non-final |A| since there is no harmony affected the element |A|.

High vowels are provided with a variable headed ATR-element that is *segmentally licensed* by virtue of (28biii). In mid vowels it would seem that only the headedness of the ATR-element is variable and needs to be licensed. In both cases, a headed ∀-element to the right will act as a licensor. In the case of high vowels the licensor will turn (∀) into |∀| and in the case of mid vowels it will turn |(∀)| into |∀|.

It might be objected that it is suspect to declare the headedness relation as variable in one case and an actual element as variable in another case. But the difference is only apparent[17], due to the fact that we have been using the underlining notation for headedness. That both instances of licensing are not really different can be shown when we realize that the underlining notation is a short hand for a proper constituency notation in which elements, or element combinations, form a *headed gesture constituent*. If a gesture contains two elements, the head element delivers the label of the whole constituent and if there is only one element then the label is delivered by this element. This means that the representations in (30a) are the full versions of the short hand notation in (30b).

[16] The parentheses are around the underlining only.

[17] As Beata Moskal pointed out to me.

(30)

	mid vowel	*high vowel*	
a. i.	∀ ∀ A	ii. ∀ ∀	
b.	∀ A	∀	Short hand

Given that this is so, (31a) is the full representation for (31b):

(31)

	mid vowel	*high vowel*	
a. i.	(∀) ∀ A	ii. (∀) ∀	
b.	(∀) A	(∀)	Short hand

If the structure in (31ai) is licensed by a |∀| that is a head, we thereby license its element |∀| to be the head of the compound |∀A|, hence |∀A|. If this structure is not thus licensed, the element |A| will automatically become the head because one of the elements in a compound must be the head. If the structure in (31aii) is licensed by |∀| we get |∀|. However, if it is not licensed, we get the result that the gesture cannot contain the |∀| element at all. This shows that both in mid vowels and in high vowels, the same part of the structure is variable, namely the head label of the gesture constituent.

This analysis is incomplete in one important respect. A root that is not marked as |∀|-headed must nonetheless have advanced vowels to the left of /i/ and /u/. As explained in Section 2, we would expect /i/ and /u/ to *not* display this behaviour and it therefore comes as no surprise that we need an extra statement. In our 'non-spreading' model, we cannot derive this in terms of a 'free ride'. Instead we must state a rule:[18]

(32)

NON-FINAL /i/ and /u/ are allowed to laterally license

[18] Here I need to make special provisions for disharmonic roots that would meet the conditions for this rule since the rule in (32) should obviously not apply to these.

Rule (32) presupposes that |∀| is specified as a property for /i/ and /u/, even though the ATR element is predictable for these vowels. In these vowels, the headed instance of |∀| is segmentally licensed. If we would assume that the ATR element is unspecified for /i/ and /u/ we would have to adopt a convention that the redundant element is inserted prior to the rule in (32), which is of course analogous to the convention that AP use.

In (33) I present some sample representations ('/<' means that licensing cannot obtain):

(33)

a. Non-∀ roots

i. (∀) < (∀)

A		A
U	U	U

o w u r ɔ 'morning'
(rule 32)

ii. ∀ ∀

A	
I	I

ɛ b i 'guilt'

iii. (∀) /< ∀

A	A
I	I

ɛ s ɛ 'foot'

b. ∀ roots

i. (∀) < (∀) < ∀

A		A
U	U	U

o g u r o 'upright'
(rule 32)

ii. (∀) < ∀

A	
I	I

e b i 'hunger'

iii. (∀) < ∀

A	A
I	I

e b e 'heap for yams'

- In (33ai), although the variable element of the vowel /u/ is segmentally licensed, it can license laterally because of rule (32).
- In (33aii) the headedness of /o/ is positionally licensed. As such, it licenses the variable element of /u/ because lateral licensing overrules its inertness. Subsequently, the variable headedness of the initial /o/ is licensed as well. In this case, however, the vowel /o/ is advanced for two reasons. It is advanced because its variable element is licensed by the final vowel and it is advanced because rule (32) applies.
- The contrast between (33iia) and (33iib) lies in the fact that the initial vowel in (33iia) is A-headed, whereas the initial vowel in (33iib) has variable headedness.
- The contrast between (33iiia) and (33iiib) lies in the fact that the final vowel in (33iia) is A-headed (which can therefore not license the headedness of |∀| to its left), whereas the final vowel in (33iib) has headedness which is positionally licensed, this licensing the variable headedness of the first vowel.

In many respects, this is all very similar to a RUT-analysis in which [+ATR] is the active value. The main difference is that we need the rule in (32) because we use a non-spreading model, which makes the 'free-ride' option unavailable.[19]

In conclusion, and I stress this again, the RcvP analysis, which in my view is the best and most elegant analysis using the RcvP model, is pretty much equivalent to a RUT analysis that uses [+ATR] as the spreading value.[20] Since different models are being used, we cannot argue for the superiority of either analysis.

As mentioned in footnote 20, I will consider an alternative analysis of Standard Yoruba, involving active A in Section 8.

5. Ifɛ Yoruba

In Ifɛ Yoruba the situation is different from the Standard dialect (Orie 2001, 2003). In particular, in case of trisyllabic roots, mid vowels before medial high advanced vowels must be retracted. Thus in parallel to the words in (7) we find:

(34)

a.	ɛlubɔ	'yam flour'
b.	ɔwurɔ	'morning'
c.	ɔkurɔ	'palm kernel'
d.	ɔrukɔ	'name'
e.	ɛrupɛ	'earth'
f.	ɛwurɛ	'goat'
g.	ɔdidɛ	'parrot'

[19] We can get closer to the spreading analysis by adopting a *general* copy approach. In this case we will say that the morphemic ∀-element is assigned to the final vowel (as a non-variable element). Then we adopt a copy which assigns a ∀-copy to each vowel that stands to the left of a ∀-specified vowel. In this analysis we do not need the rule in (32) or rather this rule (as an analogue to AP's rule 5) would cover all occurrences of the ATR element, both those to the left of the floating element that has first been docked onto the final vowel and those that belong to the high vowels /i/ and /u/. I compare the two alternatives in van der Hulst (ms. *b*), providing arguments in favor of the licensing approach. The basic reasons for using variable elements and licensing have been outlined in Section 3.2.

[20] Parallel to the [–ATR] analysis of Archangeli and Pulleyblank, we *could* also analyze the facts at hand by assuming that the A-element is active, as originally proposed in van der Hulst (1988*b*). I refer to Section 8 for further discussion of this alternative.

Thus, Ifɛ Yoruba lacks one of the two patterns in (3). This means that we only have to deal with the top half of the schema in (14), here repeated as (35):

(35)

	Spreading feature:	[–ATR]	[+ATR]
a.	*...e/o/ – a	unexpected	expected
b.	*...ɛ/ɔ – i/u – V	expected	unexpected

In this case, then, there is no choice between two possible analyses; it is clear that the dominant element must be |∀|.[21] Clearly the Ifɛ dialect does not have rule (32). Non-final high vowels are inert (e.g., non-active as licensers).

However, there is one *other* respect in which Ifɛ differs from Standard Yoruba. In *polysyllabic* roots *ending* in /i/ or /u/ a preceding mid vowel must be advanced. This means, for example that 'hunger' (MM) and 'guilt' (LM) are near-homophones (apart from the tonal patterns); see (4b, c). Therefore Ifɛ *appears* to have a rule similar to rule (36):

(36)

FINAL /i/ and /u/ are allowed to laterally license

In trisyllabic roots ending in /i/ or /u/, if there are two preceding mid vowels, both have to be advanced as shown by the form *ororí* 'grave, headstone'. This means that, contrary to what we see in standard Yoruba, final high vowels are active as lateral licensers. However, we do *not* need rule (36) because it is precisely predicted that final /i/ and /u/ will be able to license a preceding variable element because in final position their elements is positionally licensed.

Let us illustrate *how* the transparency of the high vowels comes about. In (37a), the high vowel 'does nothing'. Its height element is segmentally licensed and thus inert. In (37b), the inertness of the high vowel is overruled by the fact that it is laterally licensed:

(37)

a.

ɛ	l	u	b	ɔ	'yam flour'
(∀)		(∀)			
A				A	
I					
		U		U	

b.

e		u	r	o	'bitter leaf'
(∀)	<	(∀)	<	∀	
A		A			
I					
		U		U	

[21] Although AP do not provide an analysis of this dialect, I assume that they would analyze the system as having [+ATR] active.

Thus, in the form *euro* 'bitter leaf' the final element is licensed by positional licensing and the other two variable elements by lateral licensing.

6. Ijẹṣa/Ekiti Yoruba

There are also dialects of Yoruba that do *not* lack the high retracted vowels, such as the Ijɛṣa dialect (Bamgboṣe 1967), which has the same pattern as the Ekiti dialect described in Orie (2003). These dialects, like Ifɛ, have rule (36), which means that before final /i/ or /u/ vowels are advanced.

(38)

a. *A 9-vowel system, fully specified*

/ɨ/	/ʉ/	/ɪ/	/ʊ/	/e/	/o/	/ɛ/	/ɔ/	/a/
∀	∀			∀	∀	∀	∀	
				A	A	A	A	A
I		I		I		I		
	U		U		U		U	

b. *Constraints*

i. Aperture: ¬ ∅ "cannot be empty"

ii. Colour: ¬ (I ∧ U) "I and U do not combine"

iii. Cross-gestural: ∀→ I v U "∀ implies colour"

In such dialects, the analysis is exactly the same as in Ifɛ. Beyond acknowledging that this dialect has high retracted vowels (which means that colour no longer implies the ∀-element; cf. 28biii and 38biii), it would seem that nothing extra needs to be said. As we expect, /a/ will block the leftward licensing of the ATR-element and high vowels will simply participate rather than being inert.

The following examples demonstrate the fact that high vowels are retracted when occurring in retracted stems:

(39)

a. ɛlʊbɔ 'yam flour'
b. ɔwʊrɔ 'morning'
c. ɔkʊrɔ 'palm kernel'
d. ɔrʊkɔ 'name'
e. ɛrʊpɛ 'earth'
f. ɛwʊrɛ 'goat'
g. ɔdɪdɛ 'parrot'

However, as Orie (2003) points out, high retracted vowels occur *only* if they are followed by a mid or low retracted vowel and thus not in CV stems or finally in CVCV stems. It would appear that the constraint *[+high, –ATR] (cf. 2a, or its equivalent 26biii) is still applicable, albeit restricted to the stem final syllable. In other words, the contrast between high retracted and advanced vowels is *neutralized* in the stem final syllable only. Since the final syllable is the primary locus of the contrast between advanced and retracted vowels to begin with, this means that the ATR distinction for high vowels can never be distinctive in the sense of being the sole difference between two morphemes. The distribution of advanced and retracted high vowels in Ijẹṣa/Ekiti can now be stated as follows:

In CVCV stems:

- if they are followed by an advanced mid vowel they are advanced as a result of the regular harmony, else they will be retracted.
- if they are followed by a high advanced vowel in a CVCV stem, they are advanced by virtue of rule (32) which demands advanced vowels before final /i/ and /u/.

In CVCVCV stems:

- whether in the first or the second syllable, if they are followed by an advanced mid vowel they are advanced as a result of the regular harmony, else they will be retracted.
- if they occur in the first syllable and second syllable of a trisyllabic root, their value depends on the vowel in the third syllable.

Summarizing, the behaviour of high vowels in the three dialects differs as follows:

(40)

	Standard Yoruba	Ifɛ Yoruba	Ijẹṣa/Ekiti Yoruba
Final	[+ATR] inert	[+ATR] active	[+ATR] active
Non-final	[+ATR] active	[+ATR] inert	[+ATR] or [–ATR]

All dialects share the property that final high vowels are always advanced. Whereas in Ijẹṣa/Ekiti non-final high vowels are harmonic, they are not in the other two dialects which display a reversed behaviour of this class of vowels.

7. Prefixes

Yoruba is sometimes described as an isolating language. There are no suffixes, but there are some prefixes. The following examples show that prefixes harmonize with stems:

(41)

a.	ɔdɛ	'hunter'	dɛ	'hunt'	(AP 25)
b.	ero	'a thought'	ro	'think'	
c.	ɛrɔ	'machine'	rɔ	'fabricate'	
d.	ɔta	'person who is a good shot'	ta	'shoot'	
e.	oku	'corpse of person'	ku	'die'	

(42)

f.	obi	'parent'	bi	'give birth'	(OO)
g.	ebi	'family			
h.	ibi~ubi	'manner of birth'			
i.	ikuˑ	'death'	ku	'death'	
j.	oku	'corpse'			

What these cases show is that roots consisting of the neutral vowels /i/ or /u/ select advanced prefixes which is regularly the case in Ifɛ and Ijẹṣa/Ekiti. This behaviour of /i/ and /u/ is consistent with rule (32).

However, the standard variety shows variability:

(43)

obi	'parent'	(OO)
ɛbi	'family	

The same holds for polysyllabic roots that have only /i/'s and /u/'s, e.g., roots that only contain high vowels are always preceded by advanced vowels in Ife and Ijesa/Ekiti, whereas the standard shows variability in these cases. As for the variability, we see from the examples given that the same root (/bi/ 'gave birth') can have an advanced form for one prefix and a retracted form for another prefix, the choice being non-variable for each given prefix. This variability is difficult to account for since it concerns the same stem. If we assume that the forms in (42) are lexicalized (and act as monomorphemes), we could say that the form for *parent* has a morphemic height element, whereas the form for *family* does not. (Thus their treatment would be analogous to the pair *hunger* and *guilt* in 4).

8. Back to Standard Yoruba

Earlier, in footnote 20, I stated that parallel to the [–ATR] analysis of Archangeli and Pulleyblank, we *could* also analyze the facts in Standard Yoruba by assuming that the A-element is active, as was proposed in van der Hulst (1988b). If we would do that, we no longer need a rule like (32). In fact, if |A| is the active element, licensed in final position, we predict that to the left if /i/ and /u/ vowels must be non-advanced because the high vowels would act opaquely, unable to license the variable A and disallowing the variable element (A) to be licensed by a potential licenser to their right. In this analysis 'high mid' vowels would contain the variable headed A-element: (A). If licensed by a following headed A-element, they would come out as mid and otherwise as non-advanced high:

(44)

a. *A 7-vowel system, fully specified*

/i/	/u/	/e/	/o/	/ɛ/	/ɔ/	/a/
∀	∀			∀	∀	
				A	A	A
I		I		I		
	U		U		U	

In other words, '/e/' and '/o/' would really be /ɪ/ and /ʊ/ in this analysis. /e/ and /o/ would be the missing vowels in this analysis.

b. *Constraints*

i.	Colour:	¬ (I ∧ U)	"I and U do not combine"
ii.	Cross-gestural:	¬ (∀ ∧ A)	"∀ and A do not combine"

The examples in (13) would then come out as follows, although the symbols 'e' and 'o' should thus be mentally substituted by 'ɪ' and 'ʊ':

(45)

a.

i/u	e/o

b.

	A
i/u	ɛ/ɔ/a

c.

(A)	
e/o	e/o/i/u

d.

(A)	< A
ɛ/ɔ	ɛ/ɔ/a

e.
A
a e/o/i/u

f.
(A) < A
a ɛ/ɔ/a

g.
(A)
e/o i/u e/o/i/u

h.
(A) A
e/o i/u ɛ/ɔ/a

i.
(A) < A
ɛ/ɔ a e/o/i/u

j.
(A) < (A) < A
ɛ/ɔ a ɛ/ɔ/a

This analysis is consistent with the model that is proposed here and its advantage is that the behaviour of /i/ and /u/ is *directly* explained, rather than being stipulated in a rule like (32). There is, however, one observation that we should make. The element A of the vowel /a/ is *always* active, not just in final position. This element, then, is not functioning as a predictable element (even though there is no counterpart vowel that misses this element, which would be an 'empty vowel') and the reason for this, I assume, is that it is the *only* element that makes up this vowel.

In this analysis the difference between the standard dialect and the other two dialects lies in a reinterpretation of the nature of the harmony. Assuming that the original pattern is due to ∀ being the active element, speakers of the standard dialect have *reanalyzed* the status of 'e' and 'o' as 'ɪ' and 'ʊ' (which are acoustically very similar) which has resulted in A being the active element. As predicted this reanalysis has caused /i/ and /u/ to be opaque. In sum, I think that this analysis of Standard Yoruba should be preferred.

9. Nevins (2010)

Nevins (2010: 103–105) argues that the difference between Standard Yoruba and Ifɛ Yoruba lies in the following. All mid vowels that are non-final must copy a value for [ATR] from a vowel to their right. Final vowels are lexically specified as either [-ATR] or [+ATR]. In Ifɛ Yoruba the copy rule is only sensitive to *contrastive* specifications. Hence, high vowels are ignored and thus transparent. But this fails to account for the fact that before final high vowels, mid vowels must be advanced. In Standard Yoruba *all* values of ATR count as relevant which means that high vowels are not transparent. But this fails to account for the fact that before final high vowels, mid vowels can be advanced or

retracted. Nevins's analysis focuses on the trisyllabic roots with medial high vowels and thus does not offer a complete account.

Nevins does not explicitly discuss the approach that AP offer of standard Yoruba and hence does not consider the possibility that both dialects differ in which value is active. Nor does he consider the possibility that in both dialects [+ATR] is active, the difference being that standard Yoruba has a rule that makes vowels [+ATR] to the left of non-final /i/ and /u/, whereas a similar rule in Ifɛ only applies before final /i/ and /u/. Both alternatives preserve locality as a property of vowel harmony. Nevins, in general, rejects underspecification approaches. All values are specified all the time, whether contrastive or not. Whatever the justification for this (see van der Hulst, to appear), his decision comes at a high price, which is that vowel harmony relations do not have to be local. Nevins also does not consider approaches that use unary elements, which, as shown here, share with the underspecification approaches that locality can be maintained. (Also, in the unary analysis no appeal is made to any under- or non-specification of predictable unary elements, such as the height element in high vowels.) It seems to me that, before locality is sacrificed, alternatives need to be more fully explored. There are two such alternatives, RUT and RcvP.

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Strictly conservative vs. moderately revolutionary: a typology of Q-Celtic and P-Celtic stop mutations

Krzysztof Jaskuła

1. Introduction

Languages display a wide variety of change and alteration which take place both at the same time and across time. For example, in Japanese the stop [t] can be a contextual variant of /r/, while [d] may be an allophone of /l/ in Lumasaaba (Carr 1993). Such peculiar conclusions can be reached provided that an investigation of a given tongue is phonemic and that allophones are viewed to be part of the analysis, which standpoint is not advocated in this paper. In the Celtic languages, variations, both synchronic and diachronic, also occur, but they seem to be less spectacular and more conservative, at least with respect to what kinds of segments are related to other types. Nonetheless, we can observe a clear dichotomy as regards the conservatism in Q-Celtic languages versus the modest revolutionism in the P-Celtic branch.

Let us first consider two possible typological norms: (i) if different mutations affect the same radical segments in two or more branches of the same linguistic family in the same context at the same time, this normally means that we deal with subfamilies which are unalike, (ii) if dissimilar changes occur in the same segments of the same subfamily, this necessarily means that we are dealing either with a different time of modifications or with diverse contexts or processes. These will be shown to work in Celtic.

It is generally assumed that Modern Irish (Q-Celtic) is characterized by two word-initial consonant mutations (involving mostly stops), while Modern Welsh (P-Celtic), by three. This implies that Irish is more conservative, while Welsh more revolutionary in this respect. Breton, another representative of P-Celtic, is said to display as many as five mutations. It is not unknown, however, that these alterations are synchronically not phonological but morpho-phonological, i.e., they are not triggered by factors which are locally present or contemporarily active.

It will be presented below that the number of officially recognized mutations at present need not mean that the language in question has undergone the same number of diachronic modifications. Moreover, it will be shown that some languages or subfamilies of tongues have a drift or tendency towards some modifications which other languages or subfamilies eschew. The ensuing discussion is confined to word-initial stops.

THE JOHN PAUL II CATHOLIC UNIVERSITY OF LUBLIN
FACULTY OF HUMANITIES
INSTITUTE OF ENGLISH STUDIES

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EDITED BY
EUGENIUSZ CYRAN, HENRYK KARDELA, BOGDAN SZYMANEK

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