Optimality Analysis of Vowel Harmony in ÀÍKA

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Abstract

This paper gives an Optimality Theory (Henceforth OT) account of advanced tongue root (ATR) vowel harmony in ÀÍKA[1], an Edoid[2] language that consists of four speech forms spoken in Akoko-Edo area in Nigeria. The ATR harmony manifests within as well as across morpheme boundaries. The ATR harmony across morphemes affects the subject pronouns, prefixes as well as demonstrative pronouns because they are underspecified for ATR value while object pronouns are underlyingly specified. It is further noted that ATR has a morphological effect on the items it affects as it triggers phonological allomorphy in them. In addition to right-to-left spreading analysis in the literature (Abiodun 1999, Ibikunle 2014, and 2016), this research further reveals that there are pieces of evidence for left-to-right spreading of harmonic value. More importantly, this analysis shows that OT is viable and problem-solving efficient compared with the Non-Linear or traditional generative account on Vowel Harmony system of the language.

Keywords: Vowel harmony, ATR, Optimality theory, ÀÍKA, Pronouns.

1. Introduction
ÀÍKA is an Edoid language spoken in four different villages namely: 'Ìígáú' spoken in Àúga, Ìísheù spoken in Íshè, Ìkààn spoken in Kákùmọ̀ and 'Ìyínnọ́' spoken in Ayánrán. Ìkààn and Ìyínnọ́ are spoken in Akoko-Edo area in Edo State while Ìígáú and Ìísheù are spoken in Ondo State all in Nigeria.
The motivation for this research paper is to show that ÀÍKA does not only operate a leftward but also a rightward movement in its ATR spreading technique. This is evident when someone considers the ATR harmony relationship between the plural demonstrative pronouns 'these/those' and the vowels of the preceding nominal item in the language. The vowel harmony of the language therefore supports the claim that ATR harmony is one of the features licensed to have a bidirectional spreading.
This rightward spreading of the ATR harmony in question will pose difficulties for Autosegmental theory to analyze as shown in section 4.3. This being the case, the OT which is viable to account for the rightward spreading is employed in the analysis.

2. Review of Relevant Literatures
At the undergraduate, masters as well as Ph.D. levels, there have been some few works on Phonology of the language. The two known Ph.D. works on the language: Abiọdun (1999) and Salffner (2009) are carried out using A Non-Linear (Autosegmental) Approach where both of them did not focus on the vowel harmony system of the

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[1] This language is also known as Ùkààn/Ìkààn in the literature. (see Arohunmolase et al 2006, Abiodun 1999, Salffner 2009 among others)
2 Arohunmolase et al (2006) classify the language under Benue Congo family alongside Akpes, Edoid, Defoid among others while Elugbe 2001 classifies it as the oldest branch of Edoid, more closely related to Akpes than to other Edoid languages.

language. Abiodun's work was on the comparative phonology and morphology of the language while Salffner's work was purely on tone in the Phonology, lexicon and grammar of the language.

For the vowel harmony in ÀÍKA, Abiodun (1999:87) says that 'vowels within a phonological word agree with respect to the feature [ATR]…' The language data he examined consist of subject pronouns, singular and plural prefixes and concord prefixes. Abiodun states that: '…subject pronouns, particularly singular forms, show allomorphic variation in all the dialects of Ukaan. The variation is normally determined by the [ATR] feature of the vowels in harmonic roots'. This is the case of leftward spreading of ATR while this paper reveals evidence of rightward spreading.

According to Salffner (2009:55), the vowels of the language are distinguished by height and fronting as well as contrastive ATR value, length and nasality…the only gaps so far are /ẽ:, ɔ:/. This research does not show any evidence of long vowels in the language; I considered those she transcribed as long vowels to be two similar but discreet vowels with discreet tones that occupy two different syllable peaks in sequence.

Ibikunle (2014 and 2016) proposes a right-to-left analysis for the harmony system in the language. This research sees beyond this as the harmonic relationship between a noun and the plural demonstrative pronouns 'these/those' reveals a left-to-right spreading of ATR value. This later discovery supports the claim that ATR harmony is bidirectional in its spreading techniques.

3. The ATR Harmony Process

Many researchers have expressed their views on vowel harmony as a phonological process in human languages. Kenstowicz (1994: 347) captures the view of such researchers thus:

"Vowel harmony is a phonological state in which the vowels in a given domain share or harmonize for a particular feature…typically all of the vowels of the language participate in the harmonic constraint. In addition, the harmony applies in an essentially unbounded fashion, affecting all the relevant vowels within the domain. Virtually any of the common features used to distinguish among vowels have been discovered to seat a harmonic system, including vowel height, backness, rounding, nasality and pharyngeal opening or [ATR].

Simply put, vowel harmony makes the vowels in a specific domain to sound alike. It is a kind of assimilation which requires that vowels in a certain domain should share some phonetic features such as vowel height, backness, rounding, nasality and pharyngeal opening or [ATR].

Research shows that, vowel harmony is a common phonological phenomenon in many languages in Africa while ATR is a common course. The tongue root is the principal actor in ATR harmony. The root of the tongue may project forward to expand the pharyngeal cavity (Agoyi 2008)

3.1 Vowel Inventory of ÀÍKA

The vowel inventory for AIKA includes contrast for three heights (high, mid, and low), two horizontal positions (front and back), and advanced-retracted. Advancement is the feature central to AIKA vowel harmony, and the table below is organized to convey that.

Table 1

[-ATR]	Front	Central	Back	[+ATR]	Front	Central	Back
High	ɪ		ʊ	High	i		u
Mid	ɛ		ɔ	Mid	e		o
Low		a		Low			

All of these 9 vowels are contrastive and they all have nasal counterparts.

3.2 Vowel Under specification

Under specification is good to use when some features of the surface segment is always determined by another segment. If it depends on something else, it has no identity of its own. In this case, it is assumed that the vowels of the subject pronouns, prefixes as well as demonstrative pronouns are underspecified for ATR in the language. Their ATR value is determined by the roots in their environment. An underspecified segment is writing with a technical symbol called an archiphoneme. This is demonstrated in section 4.

4. The Data

The data in the next two subsections show vowel harmony within as well as across morpheme boundaries

4.1   Lexical Vowel Harmony

The assumption here is that the last vowel in a nominal root is specified for ATR value but it only spread on the underspecified preceding vowels, affixes, subject pronouns or demonstrative pronouns around it.
       [ATR] Harmony within morphemes can be shown thus:
              Ìyínnṓ

1. SET A [+ATR]   SET B [–ATR]
       /Èhú/   =[èhú]   'rat'   /Ènɔ́/   =[ɛnɔ́]   'meat'
       /Ìhwe/ =[ìhwé] 'seed'   /Àtɔ̀/ =[àtɔ̀]   'lie'
       /Òjĩ̀/   =[òjĩ̀]   'child'   /Àʃʊ/ =[àʃʊ]   'cloth'
       /Ùwé/   =[ùwè]   'leg'   /Ùfɪ/   =[ɒfɪ̃]   'thing'
       /Òjù/   =[òjù]   'wind'   /Òʃɛ̃/   =[ɔʃɛ̃̀]   'mat'

The data above reveal a harmony agreement between all the vowels in the lexical root as shown on the right. I assume that the second vowel predicts or determines the ATR value of the first (i.e. V_2 is the trigger) that is why the first vowels are represented with archiphonemes at the left to show that they are underspecified. This assumption is based on two reasons: first, the language operates no suffixes but prefixes whose harmonic value is determined by the value of the root vowel. The second reason being that majority of the spreading techniques of the vowel harmony in the language are leftward with only one instance of rightward spreading.

4.2 Harmony Across Boundaries

ATR harmony affects the subject pronouns and the following lexical item such as verbs. This kind of harmony does not exist between the object pronouns and the preceding lexical item. This is to say that the directionality of the spreading is leftward (right-to-left) rather than rightward (left-to-right) in this regard.

The data in 2a below illustrate how the subject pronouns are realized in sentences.

              Ìígáú

2. a [-ATR]   [+ATR]
[dʒɛ́ jáfɪ̃ ɔ̀hɔ́] 'I licked up the soap'   [dʒe rúàg ùmó] 'I poured the water'
I lick soap   I   pour water

[hɛ̀ jɔ́wì lɛ́bɔ] 'you called us'   [hè ʃédʒì ìhʷé] 'you stole the money'
you call us   you steal money

[ɔ̀ ɲàgɛ̀ awu] 'he tore the cloth'   [ò víè odʒòdʒ] 'he descended from a rock'
he tear cloth   he descend rock

[ɛ̀ jɔr séni]   'it flew away'   [è kũ lébɔ]   'it tied us'
it fly far   it tie us

This being the case, the ATR harmony has a morphological effect on the subject pronouns as they now have allomorphic variations. The subject pronouns are underspecified in the language as shown below:

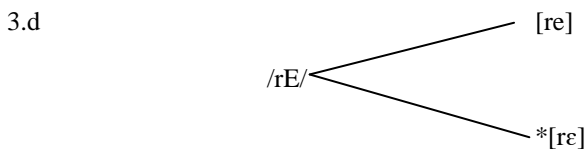|	Ikaan	Ìyínnɔ́	Iigau	Ìsheu	Gloss
2.b.(i)	/ʤÈ/ [ʤè/ʤɛ̀]	/ʤÒ/ [ʤò/ʤɔ̀]	/ʤÈ/ [ʤè/ʤɛ̀]	/ʤÒ/ [ʤò/ʤɔ̀]	I
(ii)	/hÈ/ [hè/hɛ̀]	/hÒ/ [hò/hɔ̀]	/hÈ/ [hè/hɛ̀]	/hÒ/ [hò/hɔ̀]	you
(iii)	/Ò/ [ò/ɔ̀]	/Ò/ [ò/ɔ̀]	/Ò/ [ò/ɔ̀]	/Ò/ [ò/ɔ̀]	he
(iv)	/È/ [è/ɛ̀]	/È/ [è/ɛ̀]	/È/ [è/ɛ̀]	/È/ [è/ɛ̀]	it

4.3 The Plural Demonstrative Pronouns

The data for these pronouns indicate an area where the language could spread its harmony in a rightward (left to right) direction. The data in 3a and b below indicate how the plural demonstrative pronouns are realized in noun phrases.

Ìsheu

3.a	[+ATR]		[-ATR]	
	[èrî re]	'those elephants'	[àʃɛ̀ ra]	'those eggs'
	[èhwí re]	'those corpses'	[àgò ra]	'those thorns'

Iigau

3.b	[+ATR]		[-ATR]	
	[eso rè]	'those seeds'	[àkàʤì rà]	'those villages'
	[èhú rè]	'those days'	[àhɔ́ rà]	'those arms'

The variants of the demonstrative pronouns is shown in 3c below

	Ìsheu	**Iigau**	
3.c	/rE/	/rE/	
	[re/ra]	[re/ra]	'these/those'

Non-Linear/Autosegmental theory would fail in accounting for the final derivation of the plural demonstrative pronouns given in '3' above. This is because, in Autosegmental analysis of this kinds of data, the spreading of [-ATR] on the archiphoneme [rE] from the preceding syllable will rather generate *[rɛ] which is ill-formed in the language. The reason for this is simple. The archiphoneme [rE] could either be realized as [re] or [rɛ] after the spreading of an ATR value in Autosegmental analysis as in:

3.d

/rE/ ———< [re] / *[rɛ]

The rule(s) that will further account for the derivation of [ra] from [rɛ] is not clear in Autosegmental analysis for the fact that the high vowels among others are not transparent in the language. This difficulty is unarguably resolved with the use of constraints in OT. We will explain how OT resolves this problem in section 6 using five constraints that includes the markedness constraint *[MID,-ATR] which states that "A mid vowel must not be produced with retracted tongue root".

5. Optimality Theory: An Overview

It had been observed, since the early days of Generative Phonology, that many phonological rules were born out of the desire by Language to maintain some phonological constraints in a language.

Optimality theory is the current standard phonological model. OT was formally proposed in the early 1990s with the work of Alan Prince, John McCarthy, and Paul Smolensky. In OT, all languages share the same set of aspirations. This set is finite and universal, but includes contradictions. It is the constraints and the ways they conflict that shapes language outputs. They form the basis of sound patterns.

There are two major classes of constraints that pull the output in opposite ways: faithfulness constraints and markedness constraints. Faithfulness constraints make some comparison between the output and the input. For a faithfulness constraint to be satisfied, the output will have to resemble the input in some meaningful way. Markedness constraints demand that an output be easy to pronounce. Marked sounds and combinations of sounds are the less common ones and the harder ones to pronounce. For a markedness constraint to be satisfied, the output will need to have some property that makes it easy on the speaker.

Faithfulness constraints are good for listeners. The more direct information they have about the input, the less work they have to do to form an interpretation of the sentence. Markedness constraints are good for speakers. The easier the phonetic sounds of the output are to say, the less work a speaker's mouth and other articulators will have to do. In this way OT captures an intuitive fact about the social and communicative nature of language: phonology is a compromise between the priorities of the speaker and the listener.

Each language resolves this universal conflict between markedness and faithfulness in a structured way. An infinite number of possible outputs, or candidates, will be graded on the constraints usually on a pass-fail basis. Since it is impossible to satisfy all the constraints, every language has its list of priorities. The candidate that performs the best wins and is the optimal output, hence the name *Optimality theory*. Even a winning candidate will have problems. However, the phonology of a language must dictate which of these problems it can ignore and which will be deal breakers. In practice, only the most conservative/compelling candidates and the constraints relevant for the problem at hand will be shown on an Optimality tableau.

In Tableau 1, two imaginary outputs are evaluated on the imaginary constraint X. An asterisk marks each time A and B violate X. (In this case, A violates X zero times and B violates X one time)

Tableau 1: Two outputs A and B evaluated by Constraint X

/input/	Constraint X
a. [output A]	
b. [output B]	*

In Tableau 2, the same imaginary outputs are evaluated on another imaginary constraint Y. An asterisk marks each time A and B violate Y.

Tableau 2: Two outputs A and B evaluated by Constraint Y

/input/	Constraint Y
a. [output A]	*
b. [output B]	

In the next tableau 3, both constraints are laid side by side. If X is more important than Y (if X outranks Y, abbreviated X ≫ Y) then candidate A will beat B. A language like this will pronounce the input as output A. This fact is indicated by a hand that points to the winning output. When candidates lose, their downfall is marked with an exclamation point.

Tableaux 3:. How OT chooses the best output if X ≫ Y

/input/	Constraint X	Constraint Y
☞ a. [output A]		*
b. [output B]	*!	

Another language might have the reverse set of priorities. With the reverse ranking, Y is more highly prioritized than X and it outranks X (Y ≫ X). A speaker of a language like this would rather pronounce the input as output B, as shown in Tableau 4:

Tableau 4: How OT chooses the best output if Y ≫ X

/input/	Constraint Y	Constraint X
a. [output A]	* !	
☞ b. [output B]		*

5.1 *Relevant Constraints for the Vowel Harmony Analysis*

The relevant constraints for this analysis are selected from the literature. They are presented below:

IDENT-IO (ATR)   Corresponding vowels in the input and output have
                      identical specifications for ATR. (McCarthy 1997,
                      Ballard 2010)

 SPECIFY   All segments must be fully specified for features
                      (Ballard 2010)

ROOT-AGREE[ATR]   All the vowels in a root must share the same ATR value
                      (Williams 2009)

ALIGN[ATR]-L/R   Align the left or right edge of the [ATR] element with
                      the Left or right edge of the prosodic word
                      (Oyebade 2008, Agoyi 2008, Williams 2009)

*[MID,-ATR]   A mid vowel must not be produced with retracted
                      tongue root (Akinlabi 2009, Gambarage & Pulleyblank 2014)

In order to define the grammar of the language, the constraints above are ranked as follows:

SPECIFY>>ROOT-AGREE[ATR]>>[ATR]-L/R>>*[MID,-ATR]>> IDENT-IO(ATR).

6. Analysis of Vowel Harmony in ÀÍKA using OT Tableau

Tableau 5:. How OT chooses the best candidate in lexical vowel harmony

/Èhú/	SPECIFY	ROOT-AGREE[ATR	[ATR]-L	*[MID,-ATR]	IDENT-IO(ATR)
a. ɛhu		*!	*	*	**
b.Ehʊ	*!	*	*		*
c. ehʊ		*!	*		**
d. ɛhʊ				*!	**
e. EhU	*!*		*		**
☞f. ehu					**

The optimal candidate or the correct output is [ehu] 'rat' in Ìyínnọ́

Tableau 6: How OT chooses the best candidate in leftward spreading of ATR

/E kũ lɛbɔ/	SPECIFY	ROOT-AGREE[ATR	[ATR]-L	*[MID,-ATR]	IDENT-IO(ATR)
a. e kũ lebo		*!		*	**
b. ɛ kũ lebo			*!	*	***
☞c.e kũ lɛbɔ				**	*
d. E kũ lɛbɔ	*!		*	**	

The optimal candidate is [e kũ lɛbɔ] 'It tied us' in Ìígáú

Tableau 7: How OT chooses the best candidate in rightward spreading of ATR

/Aʃɛ rE/	SPECIFY	ROOT-AGREE[ATR	[ATR]-R	*[MID,-ATR]	IDENT-IO(ATR)
a. aʃe ra		*!	*		***
☞b. aʃɛ ra				*	**
c. aʃɛ re			*!	*	**
d. Aʃɛ rE	*!*		*	*	
e. aʃe re		*!			***
f. aʃɛ rɛ				**!	**
g. aʃe rɛ		*!	*	*	***
h. aʃɔ rɛ				**!	***

The optimal candidate is [aʃɛ ra] 'these/those eggs' in Ísheu

The derivation of this output poses a threat to Auto segmental theory of phonology while it is easily resolved in OT with relevant constraints.

7. Conclusion

This research shows that ÀÍKA operates ATR harmony within as well as across morpheme boundaries. It further reveals that there is a piece of evidence for left-to-right spreading of harmonic value in addition to right-to-left spreading analysis in the literature on the language. Five relevant constraints are used where one of them is faithfulness while the remaining four are markedness constraints. More importantly, the paper shows that OT is viable and problem-solving efficient compared with the Non-Linear or traditional generative account on Vowel Harmony system of the language.

References

Abiodun, M. (1999). "A Comparative Phonology and Morphology of Ùkààn dialects of Old Akoko Division". Ph.D. thesis, University of Ilorin Nigeria.

Agoyi, (2008). "The Phonology of Vowel Harmony in Àbèsàbèsì". Ph.D thesis, Akungba: AAUA.

Akinlabi, A. (2009). *Neutral Vowels in Lokaa Harmony.* Canadian Journal of Linguistics: 197-228.

Ballard, L. (2010). "Akan Vowel Harmony in Optimality Theory". M.A. thesis. Florida: University of Florida.
Elugbe, B. (2001). "The Classification of Akpes and ÀÍKA" (Unpublished).

Gambarage, J and D. Pulleyblank (2014). *Vowel Harmony in Nata and Ikoma.* UC Berkeley.

Ibikunle, A. (2014). "An Autosegmental Phonology of Ìyínnọ́ Dialect of ÀÍKA". M.A. thesis.   Ibadan: University of Ibadan.

Ibikunle A. (2016). *The Role of 'No Crossing' in the Vowel Harmony System of Ìyínnọ́.* Journal of Linguistics Association of Nigeria (JOLAN) Nigeria19 (1)

McCarthy, J and A. Prince (1993). *Generalized Alignment*: Technical Report no.3 of the Rutgers Center for Cognitive Science, New Jersey

McCarthy, J (1997). *Process-specific Constraints in Optimality Theory.* Amherst: UMass.

Oyebade, F. (2008). *A Course in Phonology.* Ijebu-Ode: Sebiotimo Publications.

Prince, A and Smolensky, P (1993). *Optimality Theory: Constraint Interaction in Generative Grammar.* Ms., Rutgers University, New Brunswick and University of Colorado, Boulder.
Salffner, S. (2009). *Tone in the Phonology, Lexicon and Grammar of Ìkààn.* PhD Dissertation.London: University of London.

Sasa, T. (2009). 'Treatment of Vowel Harmony in Optimality Theory'. Ph.D Dissertation. Iowa University of Iowa.
Williams, A. (2009). *An Optimality Theory Analysis of Vowel Harmony in Ndura.*GIAL: Occasional Papers in Applied Linguistic