Lenguas, lenguaje y lingüística

Contribuciones desde la Lingüística General

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(Eds.)

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DIRECTIONALITY IN ADVANCED TONGUE ROOT HARMONY

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1. Introduction

Advanced tongue root (ATR) vowel harmony systems are noted for variation in directionality, but there is a question as to whether directionality is ever truly specified or whether it is an artifact of morphological structure. ATR harmony in Yoruba appears to be regressive only, but that may be due to the lack of suffixes. In Tangale, harmony operates progressively only, but that may be due to a lack of prefixes. In Akan, a language with both prefixes and suffixes, ATR harmony is bidirectional, working progressively as well as regressively. The issue of directionality has been handled differently within different phonological models that propose to account for vowel harmony. Directionality is inherent in approaches that account for harmony through rankings of ALIGN-L and ALIGN-R constraints. Directionality is not inherent in the mechanism of spreading found in autosegmental theory, but it is easily encoded through rules specifying direction. Contrastively, directionality is not accommodated within approaches that account for harmony through agreement constraints or optimal spans. Indeed there are scholars who reject the notion that directionality must ever be specified. Aoki (1968), in an early effort towards establishing a unified description of vowel harmony, rejects directionality as a meaningful factor in describing vowel harmony, claiming that harmony is bi-directional in dominant-recessive systems and that morphology accounts for apparent directional effects in root-controlled systems. Clements (1981) agrees and includes bidirectionality among the properties that define vowel harmony. Baković (2000) also claims that any direction associated with vowel harmony derives from morphological structure. He argues that an agreement constraint is responsible for harmony and that the interaction of that constraint with faithfulness and markedness constraints is responsible for what appears to be directionality. However, Hyman (2002) presents strong evidence that directionality in the Bantu language Punu is not predictable from the morphology and must be specified in the phonology of the language. Casali (2008: 535) briefly discusses evidence that directionality is not always predictable and concludes that "[…] further systematic investigation of a larger sample of languages might prove helpful in resolving (or at least clarifying) the debate". This paper takes up that challenge, drawing information from a survey of seventy-one languages exhibiting ATR harmony. The survey reveals numerous cases where it appears that directionality in the operation of vowel harmony is not attributable to morphological factors and must be stipulated in the phonology. First, there are languages where harmony is strictly regressive, and the directionality is not explained by morphology. Second, there are numerous languages where harmony is bidirectional, but regressive harmony and progressive harmony are constrained in different ways.

2. Languages where harmony is strictly regressive

2.1. Karajá

Karajá (Ribeiro 2002) is a Macro-Jê language spoken in Brazil where +ATR dominant harmony is strictly regressive. The +ATR trigger is found in stems, affixes, and clitics, but targets are always to the left of the trigger. –ATR vowels to the right of a trigger remain unassimilated, while –ATR vowels to the left of a trigger assimilate. In (1a), –ATR vowels to the right of a +ATR trigger vowel remain unassimilated and surface as –ATR, whereas –ATR vowels to the left of the trigger assimilate and surface as +ATR. In the examples in this paper, the trigger vowel is underlined; unassimilated vowels are double-underlined; and assimilated vowels are underlined with a dotted line. As seen in (1b), the same vowels that remain unassimilated in the examples in (1a), surface as +ATR when followed by a +ATR vowel.

(1) a/ bədɛ-bu̲ɗɛ/	→	bəɗe̲-bu̲de̲	island
/wa-θɛ-ri̲kɔrɛ/	→	wa-θe̲-ri̲ʧɔ̲rɛ̲	my sibling
b /i- buɗɛ-re̲/	→	i-bude̲-re̲	It is little.
/wa-rikɔrɛ bo̲ho/	→	wa-riʧo̲re̲ bo̲ho	my children

(Ribeiro 2002).

2.2. Dilo

Dilo (Jones 1987) is a Niger-Congo language spoken in Ghana. The example in (2) shows that the initial +ATR vowel in the final morpheme triggers changes to –ATR vowels in preceding morphemes, but does not alter the –ATR vowel to the right. Harmony is exclusively regressive.

(2) /ɔ mʊ o̲suŋsɪ/	→	o̲ mo o̲suŋsɪ̲	he brought pots

(Jones 1987).

2.3. Mayogo

Like Dilo, Mayogo (McCord 1989) is a Niger-Congo language in which harmony is +ATR dominant and is exclusively right-to-left. In (3a), the +ATR vowels in the third person plural pronoun trigger alternations in preceding vowels. In (3b), the same vowels are unaffected when preceded by that same pronoun.

(3) a /nɪ-ʤɛ-u̲o/	→	ni̲-ʤe̲-u̲o	We understand them.
b /uo-ʤɛ-nɪ/	→	uo- ʤɛ̲-nɪ̲	They understand us.

(McCord 1989).

2.4. Kalabari

In Kalabari (Akinlabi 1994), a Niger-Congo language with root-controlled harmony, prefixes harmonize in the expected way, but suffix vowels do not. Akinlabi (1994) takes the following examples from Jenewari (1973).

(4) a	ɪ-da	my father
	i-feni:	my bird
	ɔ-tɔrʊ:	his face
	o-toru:	his chalk
	ɪyɛ-ɔbɔkɔ	my fowl
	iye-obiri	my dog
b	fomu-ba	will beat
	fomu-arɪ	is beating
	fomu-tɛ:	has beaten

(Akinlabi 1994).

ATR harmony in Kalabari is strictly regressive. Roots control the ATR identity of prefix vowels, but not the identity of suffix vowels.

2.5. Summary - Languages where harmony is strictly regressive

The facts of harmony in Karajá, Dilo, Mayogo, and Kalabari present clear evidence that the direction of harmony is not always simply an artifact of morphological structure. Directionality in these four languages is not epiphenomenal. In Karajá, Dilo, and Mayogo, +ATR dominant harmony is exclusively regressive, and in Kalabari, root-controlled harmony is exclusively regressive despite the presence of suffixes. The assumption that vowel harmony is inherently and universally bidirectional is incorrect.

3. Directional asymmetries in the operation of harmony

Directional asymmetry occurs when limitations on the operation of harmony in one direction are different from limitations on harmony operating in the other direction. One prevalent directional asymmetry involves vowels that are opaque or transparent to harmony from one direction but are affected by harmony from another direction. Harmony in Maasai (Archangeli & Pulleyblank 1994, Tucker & Mpaayei 1955) is bidirectional, with +ATR spreading both left and right, but the behavior of the low vowel is variable, depending on whether the +ATR trigger is to the right or the left. The low vowel is opaque when it appears in roots and prefixes, but it alternates in suffixes under the influence of a +ATR trigger in the root. It is not the case, however, that low vowels can be put into two classes: opaque prefix and root vowels and harmonic suffix vowels. A low vowel suffix that is affected by harmony when it is preceded by a +ATR root, is not affected by harmony when it is followed by a +ATR suffix. A similar situation is found in Turkana (Dimmendaal 1983, Noske 1990) where the low vowel is opaque in roots, but alternates in suffixes. Baković (2000, 2003) claims the variable behavior of the low vowel in Maasai and Turkana is due to the difference between root vowels and affix vowels and not due to any inherent direc-

tional effects associated with harmony. Root vowels maintain identity while affix vowels are more subject to change. As Baković (2003) admits, his account does not explain why prefix vowels are opaque in Maasai and Turkana. More importantly, however, his explanation makes the typological prediction that the pattern opposite to that found in Maasai and Turkana is impossible. There should be no languages where the root vowel alternates and the suffix vowel is opaque. Just such a pattern is encountered, however, in Alur and Bongo, two Nilo-Saharan languages. In both of these languages, the low vowel alternates in roots but is opaque in suffixes.

3.1. Alur

Alur (Kutsch Lojenga 1986) evinces +ATR dominant harmony in which +ATR spreads from roots to suffixes as well as from suffixes to roots. Prefixes do not participate[1]. It is the behavior of the low –ATR vowel /a/ that is of interest in a discussion of directionality. In suffixes, /a/ is unaffected by the presence of a +ATR vowel in the root (5).

(5) ɛ-gud-a̲ he hurt me
limb-a̲ my cheek
(Kutsch Lojenga 1986).

However, the low vowel /a/ is a target of harmony when it appears in a root followed by the +ATR suffix /i/. In this case the –ATR /a/ alternates with the +ATR /e/.

(6) ɛ-cakʊ-i̲/ → ɛ-ce̲ku̲ –I̲ he chose you (sg)
(Kutsch Lojenga 1986).

The directional asymmetry in the behavior of the low vowel seems to demand that direction be specified in the phonology. It is not explicable by reference to morphology or by a preference for maintaining root identity.

3.2. Bongo

In Bongo, as in Alur, the low –ATR vowel /a/ in a root is affected by the presence of a +ATR vowel in a suffix, but the same vowel is not affected when it appears in a suffix that follows a +ATR root. The example in (7a) shows the alternation from /a/ to [ɨ] in root vowels under the influence of a +ATR suffix vowel. The example in (7b) shows that +ATR does not spread from the root to the -ATR suffix vowel.

(7) a mbaga –ma my mother
mbɨ̲gɨ̲- i̲ your mother
b gbogbo –ma̲ my windpipe
(Kilpatrick 1985).

[1] In addition to the non-participation of prefixes, harmony in Alur is limited in that +ATR spreads to suffixes that consist of only a vowel but does not spread to CV suffixes. It should also be mentioned that while non-low –ATR root vowels participate fully in harmony, participation of the low vowel is dependent on the shape of the suffix. It is affected by the presence of a +ATR vowel in a suffix containing only a vowel, but it is not affected by the presence of a +ATR vowel in a CV suffix.

In both Bongo and Alur, harmony is bi-directional, but the behavior of the low vowel indicates that progressive and regressive harmony are constrained differently. This is evidence that two separate harmonic processes are at work. Progressive harmony makes reference to one set of constraints, and regressive harmony makes reference to a different set of constraints. The direction of harmony must be stipulated in the phonology.

3.3. Other languages with asymmetry involving low vowels

Directional asymmetry involving low vowels is also found in the Niger-Congo languages Akan, Nawuri, and Gwa Nmle as well as in five Bantu Zone C languages. In Akan (Archangeli & Pulleyblank 1994, Clements 1981, Dolphyne 1988), the –ATR low vowel is a target of regressive harmony but is not a target of progressive harmony. In Nawuri (Casali 2002) as well, the behavior of the low vowel is dependent on the location of the trigger. The low vowel is opaque to progressive harmony and blocks further spreading of the harmonic feature. The same vowel is transparent to regressive harmony[2]. In Gwa Nmle (Obeng 1995) there are limitations to the participation of the low vowel in harmony[3], but it is affected only by regressive harmony, not by progressive harmony. In Bantu Zone C (Leitch 1996), where –ATR is active, there are four languages (Nkundo, Nkengo, Losikongo, and Lwankamba) where the +ATR low vowel follows but never precedes –ATR vowels within roots. In another Bantu Zone C language (Ngombe), the +ATR low vowel can follow –ATR vowels within a root, but it cannot precede them. Next, we look at directional asymmetry that is not limited to low vowels.

3.4. Toposa

Directional asymmetry of a more general nature is found in Toposa (Schröder & Schröder 1987). In this Eastern Nilotic language, harmony is generally bi-directional with +ATR spreading from roots to prefixes and suffixes and from suffixes to roots. However, harmony that originates in a suffix is not bi-directional. Such harmony operates regressively into the root but not progressively to any suffixes that follow. The examples in (8a) demonstrate regressive spread of +ATR from the suffix to the root. The examples in (8b) show that +ATR does not spread progressively from one suffix to a following suffix.

(8) a	nya-kɪ-mʊj	to eat	a-mu̱j-i̱	I eat
			a-mu̱j-i̱t	I have eaten
b	aper-i̱-ɔ̱	I sleep on		
	a-per-i̱t-ɔ̱-t-ɔ̱r	They have slept on		

(Schröder & Schröder 1987).

[2] Casali (2002) suggests transparency is superficial in this case. He claims that /a/ is actually a target of [+ATR] spreading and surfaces as slightly raised and with a voicing quality that is characteristic of [+ATR] vowels. The important point here is that whether /a/ is truly transparent or affected by harmony, there is a directional difference; /a/ is opaque to left-to-right harmony, but is transparent or a target in right-to-left harmony.

[3] In Gwa Nmle, the low vowel harmonizes when a +ATR trigger vowel appears in the syllable immediately to the right. Low vowels further to the left of the trigger are unaffected.

Once again, harmony is neither uniformly bi-directional nor predictable from morphological structure.

3.5. Directional asymmetry - other

Directional asymmetry of various types is also found in the Niger-Congo languages Kinande, Madi, and Yoruba, as well as in five Bantu Zone C languages. In Kinande (Archangeli & Pulleyblank 2002, Hyman 2002, Mutaka 1995), in regressive harmony, both high and mid vowels to the left of the trigger are affected, and harmony on the low vowel is optional. Progressive harmony, on the other hand, targets only high vowels. In Madi (Andersen 1986), root vowels always determine the ATR quality of prefix vowels, but harmony in suffix vowels is optional. In Yoruba (Archangeli & Pulleyblank 1989, Archangeli & Pulleyblank 1994, Baković 2000, Pulleyblank 1993, Pulleyblank 1996), directional asymmetry is found in the behavior of +ATR mid vowels under the influence of a –ATR low vowel trigger[4]. +ATR mid vowels may follow the –ATR low vowel in disyllabic roots of the shape VCV, but do not precede it[5]. In Ntomba (Leitch 1996), a Bantu Zone C language where –ATR is dominant, +ATR high vowels are transparent to regressive harmony, but opaque to progressive harmony. Also in Bantu Zone C (Leitch 1996), there are four languages (Likuba, Bobangi, Lwankamba, and Mituku) where +ATR high vowels follow but do not precede –ATR vowels within roots.

3.6. Summary - directional asymmetry

It is clear that directional asymmetry is not an especially uncommon phenomenon. It is also clear that the directional differences are not always predictable based on morphology. A quick look at the data above also reveals another pattern. It appears that, in most cases where directional asymmetry occurs, regressive harmony is less restricted than progressive harmony. In the survey of seventy-one languages which evince ATR harmony, there are twenty languages which exhibit directional asymmetry in the operation of vowel harmony. Among those twenty languages, there are only three languages (Maasai, Turkana, and Ngombe) in which progressive harmony is less restricted than regressive harmony. The opposite situation, where regressive harmony is less restricted than progressive harmony is found in seventeen languages.

Thus the exploration of directional asymmetry reveals a tendency for regressive harmony to be more robust than progressive harmony. This finding is consistent with the facts of harmony in Karajá, Dilo, Mayogo, and Kalabari described earlier. In these languages, harmony operates in only one direction, and that direction is right-to-left or regressive. The survey revealed no languages in which harmony is exclusively progressive. The bias towards regressive harmony is also found in harmony within compounds and across word boundaries which comprises the third component of my argument that directionality must, in some cases, be specified and is not always epiphenomenal.

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[4] According to Archanngeli & Pulleyblank, -ATR is active in Yoruba.

[5] Baković (2000) considers this apparent directionality to be epiphenomenal. With support from previous scholars, he analyzes the VCV nouns as consisting of a V prefix and a CV root. In this case, the disharmonic forms wherein +ATR mid vowels follow –ATR low vowels are attributable to the desirability of maintaining root identity. Casali (2008) points out three potential difficulties for this analysis including the fact that it is not clear that the prefixes Baković posits have any grammatical function or meaning.

4. Discussion

The existence of regressive only harmony in Karajá, Dilo, Mayogo, and Kalabari and the existence of regressive only harmony within compounds and across word boundaries is strong evidence that, in some cases, direction is an independent parameter to which the phonology makes reference. A typological description of ATR vowel harmony is incomplete if it does not consider direction as a parameter. There are many languages where harmony is bidirectional. However, among those languages are languages where directional asymmetries indicate that two separate processes are at work. Progressive harmony makes reference to one set of constraints, and regressive harmony makes reference to a different set of constraints. It is not a new claim that more than one harmony process may be at work in a given language. Archangeli & Pulleyblank (1994) postulate that three separate harmony processes are at work in Lango. The important point here is that attempts to define vowel harmony as a unified phenomenon where direction is never specified, such as found in Aoki (1968), Clements (1981), and Baković (2000) are misguided. In some cases, harmony is unidirectional. In other cases, harmony applies in both directions, but there are two separate processes involved. These directional affects are not artifacts of morphological structure. I suggest this evidence is strong support for the notion that direction of ATR harmony must, in some cases, be specified by the phonology. In a larger sense, it appears that attempts to define vowel harmony, whether involving ATR, backness or height of vowels, as a single, uniform phenomenon which can be accounted for by making reference to one set of universal principles are misguided. Linebaugh (2007) points out substantial typological differences between vowel backness harmony and vowel height harmony and concludes that the two processes are distinctive. The evidence here strongly suggests that ATR harmony is not a single, unified phenomenon. In some cases, perhaps most cases, ATR harmony is predictable and generally bi-directional, but in other cases, direction must be specified. In addition, directional asymmetries indicate that more than one harmony process can be at work in a particular language. Thus, a typology of vowel harmony must accommodate processes that are distinct from each other and must allow directionality to be stipulated within the phonology of a specific language.

The strong bias towards right-to-left harmony among languages that evince directional ATR harmony is also an important finding, which supports Hyman (2002), who suggests that anticipatory harmony (right-to-left) is common because of pre-planning, whether articulatory, perceptual, or conceptual. The notion that pre-planning is a precursor of harmony is consistent with Ohala (1994), who argues that vowel harmony is the result of the phonologization of the phonetic process of vowel-to-vowel (VCV) coarticulation. Prezdziecki (2005) and Linebaugh (2007) find patterns of VCV coarticulation that are reflected in phonological patterns of vowel harmony, thus providing evidence for this idea. VCV coarticulation occurs in both directions: anticipatory when pre-planning is the cause and perseverative when there are carry-over effects. And as Hyman (2002) points out, some studies have revealed evidence that anticipatory coarticulation is more robust than perseverative or carry-over coarticulation (Beddor et al. 1995, Inkelas et al. 2000, Manuel & Krakow 1984). Thus, if vowel harmony is phonetically grounded in VCV coarticulation, we might expect there to be a bias towards anticipatory or right-to-left harmony. However, the findings regarding directional differences in VCV coarticulation differ greatly, and several other researchers have found that carry-over effects of VCV coarticulation are greater than anticipatory effects (Fowler 1981a, Fowler 1981b, Gay 1974, Magen 1990,

Parush et al. 1983). When the various studies of VCV coarticulation are viewed together, perhaps the most noticeable finding is that the effects are greatly variable with respect to a number of parameters. There is marked variability in terms of the relative strength of effects on F1 and F2. There is also variability across languages, across different speakers of the same language, and even within the speech of individual speakers. Given this high level of variability, it is not surprising that there is variation in directional effects as well, but this variability does require that we not claim that the directional bias in ATR harmony is traceable to directional differences in VCV coarticulation. The notion is a tantalizing one, however, and we can reasonably speculate that in some languages and with respect to the acoustic effects associated with tongue root position (generally F1), a bias in directional effects of VCV coarticulation is reflected in the directional bias found in ATR harmony.

Finally, although the connection between directionality in ATR harmony and VCV coarticulation may be tenuous, it is clear that directionality is often an independent parameter affecting the operation of ATR harmony. This finding presents a problem for the phonological models of vowel harmony that utilize agreement constraints or optimal spans that do not accommodate directionality. It also raises doubts regarding the attempts to define vowel harmony as a singular, unified phenomenon subject to a universal set of constraints.

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