Polarity in Phonology
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POLARITY IN PHONOLOGY

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This paper discusses cases of underlying representations which fail to undergo certain rules in order to keep the semantic information unaffected. If in a language L, there are for instance, two input structures A and B which meet the structural description of rule X, either A or B would fail to undergo this rule if its effect would give both structures the same phonetic output that would result in their semantic neutralization. This is referred to, to use Leopold's (1930) terminology, as polarity, a device that languages have at their disposal to keep the underlying contrasts transparent on the surface. This proposal looks in a way like Kiparsky's 'minimization of opacity principle'. There is a big difference, however, between 'minimization of opacity' and 'polarity'. The former involves a rule ordering solution such as from feeding to counterfeeding or from counterbleeding to bleeding. Polarity, on the other hand, either creates exceptions to the rule or causes the input structure to undergo another rule that would affect it in another environment. To illustrate this, I will present two cases of Kinyarwanda phonology, namely the consonant mutation with regards to g and r when they occur in minimal pairs and the deletion of the causative morpheme -y-. It is noted that when g and r occur in minimal pairs, r doesn' undergo the mutation rule to avoid neutralization. -Y- doesn't delete either when it occurs in the verb stem final position because the final output would look like a verb form that has the applicative morpheme -ir-.

Before I discuss these two cases, I will first introduce rules that are involved: These are the consonant mutation, r deletion, -y- deletion, -ir- deletion, -iz- insertic and palatal harmony.

In Kinyarwanda, the final consonant of the verb stem always changes before the perfective aspect -ye, the causative morpheme -y- or the nominalizer -yi. Thus r and g which are relevant in the present discussion become z and z becomes ž. Informal rules and examples are given in (1):

(1) a. $\begin{Bmatrix} r \\ g \end{Bmatrix} \rightarrow z / \_\_ \begin{Bmatrix} ye \\ -yi \\ -y- \end{Bmatrix}$ b. $z \rightarrow \check{z} / \_\_ \begin{Bmatrix} ye \\ -yi \\ -y- \end{Bmatrix}$

/ba-oog-a/ [booga]	/ba-oog-ye/ [booze]
'they swim'	'they have just swum'
/ba-kor-a/ [bakora]	/ba-kor-ye/ [bakoze]
'they work'	'they have just worked'
/ba-vug-a/ [bavuga]	/ba-vug-ye/ [bavuze]
'they say'	'they have just said'
/ba-bar-a/ [babara]	/ba-bar-ye/ [babaze]
'they count'	'they have just counted'
/ba-saaz-a/ [basaaza]	/ba-saaz-ye/ [baš̌aaž̌e]
'they get old'	'they have just gotten old'
/ba-za/ [baaza]	/ba-z-ye/ [baaž̌e]
'they come'	'they have just come'

The liquid r is deleted before the perfective aspect morpheme -ye if the verb stem is polysyllabic (more than two syllables) or if it is preceded by a long vowel:

(2) $r \rightarrow \emptyset / \begin{Bmatrix} \ldots VV \\ \ldots VCV \end{Bmatrix}$ -ye

/bavuur-a/ [bavuura]	/ba-vuur-ye/ [bavuuye]
'they cure'	'they have just cured'
/ba-toor-a/ [batoora]	/ba-toor-ye/ [batooye]
'they vote'	'they have just voted'
/ba-garur-a/ [bagarura]	/ba-garur-ye/ [bagaruye]
'they return'	'they have just returned'
/ba-kin-ir-a/ [bakinira]	/ba-kin-ir-ye/ [bakiniye]
'they play'	'they have just played for'

-iz- is inserted before the perfective aspect marker -ye if the verb stem ends with the causative morpheme -y- or before both aspects (perfective and imperfective) if the verb stem has both the causative morpheme -y- and the applicative -ir-:

(3) $\emptyset \rightarrow$ iz/ ... y__ye
... y+ir__aspect

/ba-oog-y-a/ [booza]	/ba-oog-y-ye/ [boogež̌e]
'they wash'	'they have just washed'
/ba-aak-y-a/ [baatsa]	/ba-aak-y-ye/ [baakiž̌e]
'they light'	'they have just lit'
/ba-vug-y-a/ [bavuza]	/ba-vug-y-ye/ [bavugiž̌e]
'they make talk'	'they have just made talk'

/ba-toor-y-a/ [batooza]
'they make vote'
/ba-rir-y-a/ [bariza]
'they make cry'
/ba-ook-y-a/ [bootsa]
'they oast'

/ba-toor-y-ye/ [batoožeže]
'they have just made vote'
/ba-rir-y-ir-a/ [baririza]
'they make cry for'
/ba-ook-y-ir-a/ [bookereza]
'they oast for'

As the examples in (3) illustrate, the causative morpheme -y- is always deleted before the perfective aspect marker -ye and before the applicative suffix -ir-. The rule is informally stated in (4).

(4) -y- → Ø / ..._+(ir)+ye

It is clear from these examples that rule ordering is of course involved. The -iz insertion rule (rule 3) has to take place first before -y- can be deleted. It is the presence of -y- that triggers the insertion.

The applicative morpheme -ir- is deleted after the causative morpheme -y- of verb stems which end with the liquid r:

/ku-rir-y-ir-a/ → kuriryiriza → [kuririza]
'make cry for'
/ku-vuur-y-ir-a/ → kuvuuryiriza → [kuvuuriza]
'to cause to cure for'
/ku-ráar-y-ir-a/ → kuraaryiriza → [kúráariza]
'to cause to spend the night for'

Note that -y- is deleted as per rule (3) and -iz- is inserted as per rule (4). Rules have thus to apply in the following order: -iz- insertion first, -y- deletion second, and -ir- deletion last.

The last rule that will be discussed in this paper is th palatal harmony rule. In this language if an alveopalatal fricative š or ž is preceded by a syllable that contains an alveolar fricative s or z, the latter gets palatalized also. This phenomenon is discussed in great detail in Kimenyi (1978). The rule and the examples follow:

(6) $\begin{bmatrix}\text{Cons}\\ +\text{fric.}\\ +\text{alveolar}\end{bmatrix} \longrightarrow +\text{palatal} \;/\; \_\_\_\; \text{V} \begin{bmatrix}\text{Cons}\\ +\text{fric.}\\ +\text{palatal}\end{bmatrix}$

/ku-sas-a/ [gusasa]
'to make bed'
/ba-uuzuz-a/ [buuzuza]
'they fill up'

/ku-sas-iiš-a/ [gušašiiša]
'to cause to make bed'
/ba-uuzur-ye/ [buužuže]
'they have just filled up'

Rule (1), the consonant mutation rule, fails to apply to r which happens to be in a minimal pair with g. Consider the following examples:

(7) /ba-ror-ye/ *baroze [baroye]
'they have just looked'
/ba-rag-ye/ *baraze [baraye]
'they have just wandered'

What we note is that instead of changing to z, the liquid deletes as if it satisfied the structural description of rule (2). The reason why it doesn't change to z in these cases is because there would be a neutralization with pairs that end with g, as the examples in (8) show:

(8) /ba-rog-ye/ [baroze] 'they have just poisoned'
/ba-rag-ye/ [baraze] 'they have just given heritage'

To keep the underlying contrasts transparent on the surface, the polarity principle intervenes and makes r undergo a more general rule that affects it in other environments. The 'minimization of opacity' principle introduced by Kiparsky cannot work here, because there would be no rule ordering which would produce the phonetic forms in (7). Of course if minimization of opacity is still maintained in phonological theory it is accomplishing the same function as polarity: to preserve both the grammatical and the semantic information of morphemes.

In a similar fashion, the causative morpheme -y- fails to undergo the deletion rule described in (4) if the verb stem ends with a liquid. Consider the following examples:

(9) /ba-vuur-y-ye/ → /ba-vuur-y-iz-ye/ [bavuužiže]
'they have just caused to cure'
/ba-kor-y-ye/ → /ba-kor-y-iz-ye/ [bakoreže]
'they have just caused to touch'
/ba-rir-y-ye/ → /ba-rir-y-iz-ye/ [barižiže]
'they have just caused to cry'

To get the correct phonetic output, the following rules are involved: the -iz- insertion rule,(rule 3), the consonant mutation rule given in (1) which changes r to z and z to ž, and the palatal harmony rule which changes z to ž before ž. Again we see that rules have to be ordered in a feeding order. The -iz- insertion rule has always to apply first fo the deletion rules to take place.

Again, the reason why -y- doesn't delete in the examples provided in (9) is because of the polarity principle. If it deleted, the following forms would be obtained.

(10) /ba-vuur-ye/→ /ba-vuur-iz-ye/ [bavuuriže]
'they have just caused to cure'
/ba-kor-y-ye/→/ba-kor-iz-ye/ [bakoreže]
'they have just caused to touch'
/ba-rir-y-ye/→/ba-rir-iz-ye/ [baririže]
'they have just caused to cry'

These surface forms are usually the phonetic realizations of verb forms that have the applicative morpheme -ir-, as shown in (11).

(11) /ba-vuur-y-ir-ye/→/ba-vuur-y-ir-iz-ye/ [bavuuriže
'they have just caused to cure for'
/ba-kor-y-ir-ye/→/ba-kor-y-ir-iz-ye/ [bakoreže]
'they have just caused to touch'
/ba-rir-y-ir-ye/→/ba-rir-y-ir-iz-ye/ [baririže]
'they have just caused to cry for'

The derivations are obtained from the following rules: (i) the -iz- insertion rules, (rule 3), the verb stem has both the applicative morpheme and the causative marker, (ii) -y- deletion rule (rule 4): it occurs before the morpheme -ir-, (iii) -ir- deletion rule (rule 5): the stem ends with r and it is followed by the morpheme -y- and (iv) consonant mutation: z changing to ž before -ye. The rules cannot apply simultaneously here either. They have to be ordered. The insertion rule, Ø to -iz- applies first and then come the deletion rules, -y- and -ir- to Ø. The mutation rule applies last. It is to avoid neutralization of verb stems that have the applicative morpheme and those that don't have it, that forms in (9) fail to undergo the -y- deletion rule.

A rule ordering solution can give the same type of results in (9), however. To get the correct phonetic forms in both (9) and (11), the consonant mutation will have to apply before the -y- deletion rule in (9) but after in (11), as shown in (12) and (13), respectively:

(12)

/ba-vuur-y-ye/	/ba-kor-y-ye/	/ba-rir-y-ye/
ba-vuur-y-iz-ye	ba-kor-y-iz-ye	ba-rir-y-iz-ye
	(-iz- insertion)	
ba-vuuz-iže	ba-koz-iže	bariziže
	(consonant mutation)	
	bakozeže	
	(vowel harmony)	
ba-vuuž-iže	bakožeže	barižiže
	(palatal harmony)	
N/A	N/A	N/A
	(y deletion)	
[bavuužiže]	[bakožeže]	[barižiže]

(13)

/ba-vuur-y-ir-ye/	/ba-kor-y-ir-ye/	/ba-rir-y-ir-ye/
bavuuryirizye	bakoryirizye	bariryirizye
	(-iz insertion)	
bavuuririzye	bakoririzye	baririirizye
	(-y deletion)	
bavuurizye	bakorizye	baririzye
	(-ir- deletion)	
	bakorezye	
	(vowel harmony)	
bavuuriže	bakoreže	baririže
	(consonant mutation)	
[bavuuriže]	[bakoreže]	[baririže]

As we see in (12), one can accept 'the minimization of opacity principle' suggestion that -y- failed to delete because of the counterfeeding relationship between the deletion rule and the consonant mutation rule. When the consonant mutation rule applies before the y deletion, the latter applies vacuously. Although it has been shown that rule ordering indeed exists (especially for those that feed each other), it is rejected here in favor of the polarity analysis. First, all things being equal, an exception to the rule approach is preferrable to a rule ordering analysis, which so doing destroys the structural description of the rule and gives the same type of result. The former analysis is also more explanatory because it precisely reveals how exceptions come into the language. Second it has been argued in Kenstowicz and Kisseberth (1977) and in Kimenyi (1978) that in other cases where the minimization of opacity has been proposed, global rules are the right analyses. That is, in order to apply, certain rules have to keep

in mind the derivational history of the phonological string. To briefly illustrate this, two more examples from Kinyarwanda are given below, namely palatalization and nasal assimilation.

Velar stops (k and g) are palatalized before front vowels (i and e) and similarly nasals are assimilated to the place of articulation of the following consonants, which in turn become h if they are voiceless stops. We note, however, that k of morphemes that end in ka- doesn't palatalize after the deletion of a and that nasals don't become m before derived h's. The palatalization case is shown in (14) and (15) and the nasal assimilation in (16) and (17).

(14) $C \rightarrow [+\text{palatal}] / \_\_\_\_ V$
$[+\text{stop}, +\text{velar}]$ $[+\text{front}]$

/a-re-a/ [areka]	/a-rek-e/ [areǩe]
'he quits'	'he should quit'
/ba-iig-a/ [biiga]	/ba-iig-e/ [biiǧe]
'they study'	'they should study'
/ku-vug-a/ [kuvuga]	/ku-vug-ir-a/ [kuvuǧira]
'to talk'	'to talk for'
/ku-biik-a/ [kubiika]	/ku-biik-iiš-a/ [kubiiǩiišša]
'to put aside'	'to cause to put aside'

Look at the following examples, however.

(15) /ba-ka-iig-a/ *baǩiiga [bakiiga] 'and then they study
/ba-ka-eend-a/ *baǩeenda[bakeenda]'and then they take
/ba-raka-iib-a/*barakiiba[barakiiba] 'may they steal'
/aka-iiño/ *aǩeeno [akeeño] 'a small tooth'

Kiparsky would account for the non-palatalization in (15) by the rule ordering solution. That is, palatalization rule applies before vowel deletion which means that the velar consonant cannot be affected since it doesn't meet the description of palatalization. The rules apply in the counterfeeding fashion.

Similarly, the reason why N doesn't become m before h can be accounted for by the minimization of opacity principl also. In this language, there are two independent rules, namely the consonant aspiration rule and the changing of N to m before h rule. Examples and the rules are given in (16) and (17).

(16) C → h/N

$$\begin{bmatrix} \text{stop} \\ \text{-voiced} \\ \alpha\,\text{place} \end{bmatrix}$$

/in-taama/ [inhaama] 'sheep'	[urutaama] 'the big sheep'
/in-tare/ [inhare] 'lion'	[urutare] 'big lion'
/in-papuro/ [imhapuro] 'paper'	[urupapuro] 'paper'
/in-ká/ [iŋha] 'cow'	[urúka] 'big cow'
/in-kóno/ [íŋhono] 'pipe'	[urúkono] 'big pipe'

(17) a. /ku-n-há/ [kuûmha] 'to give'
/in-haamvu/ [imhaâmvu] 'reason'
/in-heta/ [imheta] 'ring'

b. n → m/___h

In order to prevent the nasals in (16) from becoming m before h, the n to m rule has to apply before the consonant aspiration rule. It is clear, however, that n to m rule only affects h that occur in the underlying representation, hence global rules. The main purpose of this paper was to show tha the minimization of opacity when examined very carefully can be replaced by other types of rules such as global rules. But since there are certain cases which cannot be handled by either global rules or rule ordering, the polarity principle has been introduced to account for them. As mentioned earlier, its sole motivation is to avoid neutralization of morphemes that have different underlying representations. Despite this principle, there are many instances in which neutralization occurs. When d and g occur after a nasal (incidentally r and d neutralize after a nasal), they both undergo the mutation rule given in (1) even if they occur in minimal pairs as seen in (18).

(18)

/ku-eendaa/ [kweenda] 'to take'	/ba-eend-ye/ [beenze] 'they have just taken'
/ku-eeng-a/ [kweeŋga] 'to make beer'	/ba-eeng-ye/ [beenze] 'they have just made beer'
/ku-ruung-a/ [kuruuŋga] 'to season'	/tu-ruung-ye/ [turuunze] 'we have just seasoned'
/ku-ruund-a/ [kuruunda] 'to pile'	/tu-ruund-ye/ [turuunze] 'we have just piled'

What these examples show is that there are still many unsolved questions in phonology that one principle cannot explain or describe. The polarity principle can thus only be accepted in its weaker form which claims that certain structures may fail to undergo some general rules if their output might produce ambiguity.

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