VOWEL DELETION IN PULAAR: RIME AND NUCLEAR MERGERS AND THE ISSUE OF THE SYNTAX-PHONOLOGY INTERFACE*

Abdul Aziz Diop

In this paper I am going to analyze vowel deletion (VD, hence-forth) in Pulaar, the Mauritanian dialect of Fula. The analysis has two parts. First, after some background discussion of Pulaar vowels and Pulaar syllables I present some data and suggest a phonological analysis in the form of rime and nucleus mergers. Second, I present data that suggest that in establishing its domain of application, VD is sensitive to syntactic information. In the literature on syntax-phonology inter-face we have two main approaches: the direct-access (Clements 1978; Kaisse 1987; Odden 1990), and the indirect-access (Hyman 1990; Selkirk 1986, 1987, 1990). In this paper I will demonstrate that the generalization about the Pulaar data is not consistent with the basic tenets of either approach and that an additional statement in the formu-lation of the rule, along with either approach, will account for the data. There is a third approach in the interface between syntax and phonol-ogy that space would not permit to go into, however. It is raised in Kenstowicz (1987:229) and has to do with whether the application or blockage of (phrasal) phonological rules 'can tell us something about the surface syntactic structure — in particular something that we did not know already'.

1. Introduction

The aim of this paper is to provide an account for all the conditions under which vowel deletion and vowel spreading take place in Pulaar. The paper is or-ganized as follows: first, after a brief introduction of the vowel system I present the phenomenon from a descriptive standpoint in order to show which vowel deletes, and what the output of deletion is; then I give some background information per-tinent to the topic of the paper. Second, I present my analysis of VD in Pulaar. Third, I present two sets of data that seem to be problematic for my analysis in the sense of the rule failing to apply. For the first set I show that failure of the rule to apply has to do with prosodic information whereas with the second set I propose a solution within the syntax-phonology approach to domain definition. I conclude by demonstrating that the two major approaches to this theory of domain defini-tion, in their current formulation, cannot handle the Pulaar data.

2. Pulaar vowel deletion: a description

2.1. The vowels of Pulaar

First, an inventory of Pulaar vowels. Pulaar has five phonemic and seven phonetic vowels illustrated below in (1a) and (1b), respectively.

(1) Pulaar vowel inventory
    a. Phonemic: /i/, /u/, / ɛ/, / ɔ/, and /a/
    b. Phonetic: /i/, /u/, /e/, / ɛ/, /o/, / ɔ/, and /a/

Each of these vowels has its long counterpart but the distinction between a long vowel and short vowel is unpredictable, as illustrated in (2) where the meaning of two otherwise similar words only differs because they have one vowel realized as short in one word and long in the other member of the pair.

(2) Contrastive vowel length in Pulaar

ñol-de	'to be rotten'	ñool-de	'to win'
luɓ-de	'to lend'	luuɓ-de	'to smell bad'
hir-de	'to be jealous'	hiir-de	'to be late (sp.)'
nan-e	'left-plural'	naane	'earlier'
fere	'expense'	fee-re	'manner (spec.)'

In Pulaar the only environment in which a long vowel is predictable is when /h/ or the glottal stop (/ʔ/) is deleted (in coda position) causing the preceding vowel to lengthen. (3a-b) illustrate this. There are no complex onsets or codas in the language. In (3a) we have nominal roots followed by consonant-initial noun class agreement markers. The /h/ or the glottal stop /ʔ/ deletes and its mora is assigned to the preceding short vowel, making it realized as a long vowel. In (3b) the same roots are used either with consonant-initial noun class agreement markers whose initial consonants have been deleted (cf. Paradis (1986, 1992) for a discussion and an analysis of such initial deletion) (I call these vowel-initial markers for expository purposes), or with (vowel-initial) aspectual markers. The /h/ or /ʔ/ are then syllabified as onsets, not as codas. They do not delete in this position; therefore the vowel that precedes them does not lengthen.

(3) Predictable vowel length in Pulaar
    a. Root + consonant-initial markers

/wah-re/	[waa-re]	'beard'
/yah-re/	[yaa-re]	'scorpion'
/mah-de/	[maa-de]	'to build'
/sah-de/	[saa-de]	'to fry'
/faʔ-de/	[faa-de]	'to be headed for'
/hoʔ-re/	[hoo-re]	'head'
/fiʔ-de/	[fii-de]	'to beat up'

    b. Root + 'vowel'-initial markers

/wah-e/	[ba-he]	'beard'-pl.
/mah-i/	[ma-hi]	'build'-past
/sah-i/	[sa-hi]	'fry'-past
/faʔ-i/	[fa-ʔi]	'be headed for'-past
/fiʔ-i/	[fi-ʔi]	'beat up'-past

Long/short vowels can occur freely in the word, as shown by (4). The representation we give for Pulaar vowels is as in (5) (Goldsmith 1990) where (5a) is the underlying phonological representation and (5b) the redundancy rule that captures the fact that the feature [back] is predictable for Pulaar vowels.

(4) Distribution

Beginning	Middle	End
ɛkkaadɛ	dɛlɛp	harɛ
ɛɛwnaadɛ	faIiima	kataa

(5)   Representation of vowels (Goldsmith 1990)
    a.   Representation

$$
\begin{array}{ccccc}
\text{[-round]} & \text{[+round]} & \text{[+round]} & \text{[-round]} & \\
| & | & | & | & \\
X & X & X & X & X \\
 & & | & | & | \\
 & & \text{[low]} & \text{[low]} & \text{[low]} \\
\hline
i & u & ɔ & ɛ & a
\end{array}
$$

b. Redundancy rule

$$
\begin{array}{ccc}
\text{[α round]} & \rightarrow & \text{[α round]} \\
| & & | \\
X & & X \\
 & & | \\
 & & \text{[α back]}
\end{array}
$$

Having gone through the vowel inventory of Pulaar I now present vowel deletion in its descriptive form and discuss some of the syllable-related issues that are central to the analysis given in this paper. (For the remainder of this paper I will not distinguish between [+ATR] and [-ATR] vowels orthographically because they are irrelevant for the present purposes.)

In Pulaar, vowel deletion is observed only across morpheme boundaries. It does not take place within the morpheme itself because intramorphemically one never finds sequences of different vowels. In a configuration where two morphemes are 'adjacent'; given that the first morpheme ends in a vowel and the second one starts with a vowel the final vowel of the first morpheme deletes provided the latter is not a major lexical category, i.e. a verb, a noun, or an adjective. Typically, the morphemes in second position are: subject pronouns, conjunctions, prepositions, and the vowel-initial possessive pronoun /am/ 'my'. When the final vowel of the first morpheme deletes (across morpheme boundaries) it is the features of the initial vowel of the second vowel that are 'kept'. This is the reason why I refer to the phenomenon as deletion rather than coalescence. However, I will not dwell on this point as the data will illustrate it even better. In cases where the first morpheme (alpha) is consonant-final its final consonant becomes the onset of the initial vowel of the second morpheme (beta). In section 2.2., (6)-(8) below I de-

scribe the output of vowel deletion and the relevant data (the target vowels are in bold).

2.2. The output of vowel deletion in Pulaar

A long vowel is produced either when the (short) vowels of the two morphemes involved are identical, when the vowel of the first morpheme is high (or high and long), or when final /o/ of the first morpheme is deleted in front of /a/ of the second morpheme, as shown by (6a-f).

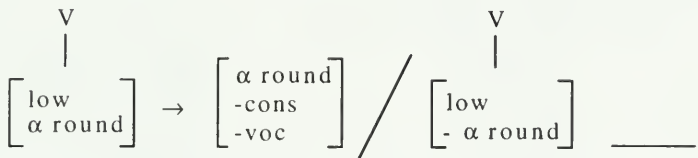| (6) | a. | hannde-e-janngo | $\rightarrow$ | hanndee janngo |
		today-conj-tomorrow		
		'today and tomorrow'		
	b.	Mali-e-Moritani	$\rightarrow$	Maalee Moritani
		Mali-conj-Mauritania		
		'Mali and Mauritania'		
	c.	ɓayri-o-yim-at	$\rightarrow$	bayroo yimat
		since-3sg-sing-Asp.		
		'since he sings'		
	d.	sabu-a-yim-at	$\rightarrow$	sabaa yimat
		because-3sg-sing-Asp		
		'because you sing'		
	e.	o-yah-ii-e-meere	$\rightarrow$	a yahee meere
		3sg-go-Asp-for-nothing		
		'he went for nothing'		
	f.	o-wii-ko-a-yah-ii	$\rightarrow$	o wii kaa yahii
		3sg-said-that-2sg-go-Asp		
		'he said that you went/left'		

A short vowel obtains when the vowel of the second morpheme is part of a closed syllable, as shown by (7a-b).

(7)	a.	o-wii-ko-on-njah-ii	$\rightarrow$	o wii kon njahii
		3sg-said-that-2pl-go-asp		*koon
		'he said that you went/left'		
	b.	o-wii-ko-en-njah-ii	$\rightarrow$	o wii ken njahii
		3sg-said-that-1pl-go-asp		*keen
		'he said that we went/left'		*koon

We get a vowel-glide sequence when we have the following (mid) vowel combinations: /a/ + /ɛ/ = ay; /ɔ/ + /ɛ/ = $ɔy$; /a/ + /ɔ/ = aw; /ɛ/ + /ɔ/ = $ɛw$, as illustrated by (8a-d). From these combinations the generalization to be drawn is that we get glide formation in Pulaar if a non-high non-low vowel is preceded by an non-identical non-high vowel. This generalization is formalized in (8e) within an SPE (Chomsky & Halle 1968) type of framework. What (8e) says is that a low vowel will become non-consonantal and non-vocalic (therefore, a glide) in the environment where it is preceded by another low vowel which differs in its rounding specification. In case the first morpheme is consonant-final the vowel of the second morpheme is syllabified with the final consonant of the first word for

which it forms a nucleus, as illustrated in (8f) below (a dot indicates a syllable break).

(8)   a.   haala-e-kawr-al   →   haalay kawral
           talk-conj-agreement-NCagr
           'talk and agreement'

      b.   wuro-e-Fuuta   →   wuroy Fuuta
           city-prep-Fuuta
           'a city in Fuuta (Region)'

      c.   ma-o-yah   →   maw yaa
           future-3sg-go
           's/he will go'

      d.   nde-o-yah-i   →   ndew yahi
           when-3sg-go-asp
           'when s/he went/left'

      e.

$$
\begin{bmatrix} V \\ | \\ \begin{bmatrix} low \\ \alpha\ round \end{bmatrix} \end{bmatrix} \rightarrow \begin{bmatrix} \alpha\ round \\ -cons \\ -voc \end{bmatrix} \Big/ \begin{bmatrix} V \\ | \\ \begin{bmatrix} low \\ -\ \alpha\ round \end{bmatrix} \end{bmatrix} \underline{\qquad}
$$

      f.   Kan-e-sehil-mum   →   ka.ne sehilmum
           Kan-conj-friend-3sgposs.
           'Kan and his friend'

Having shown the various patterns attested so far, I am going to discuss some of the syllable-related issues that are pertinent to the analysis that would be proposed for the data in (6)-(8). First, the syllable types. In Pulaar, on the surface, the following syllable types are found: CV, CVV, CVC, and CVVC. The syllable template that I assume in this paper is as proposed in Diop (1993) and shown in (9) below where aspects of both moraic phonology and X-slot theory are used (cf. Diop 1993 for further discussion of this model).

(9) Pulaar syllable template
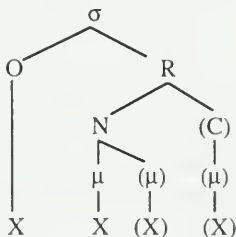
The first syllable-related issue I wish to address here has to do with weight. Following Hayes (1987; 1988; 1989) I represent vowels (and geminates) with an underlying mora whereas single consonants (in coda position) acquire a mora by

virtue of the Weight by Position (WBP) Rule (Hayes 1987; 1988; 1989) which, on a language-specific basis assigns a mora to a consonant in coda position if such mora assignment does not violate the upper-bound limit on the number of moras per syllable imposed by the language in question. The motivation for saying that WBP applies in Pulaar is as follows. There is a rule in Pulaar that shortens long vowels (in certain positions) when they are followed by a heavy syllable (cf. Diop (1993); Paradis (1986, 1992); Prunet & Tellier (1984)). This rule applies when the syllable following the long vowel is either CVV(C) or CVC, and never before CV. This is an indication that with respect to vowel shortening CVC counts as heavy (bimoraic) in the same way CVV or CVVC does. However, while CVV occurs rather freely, CVVC is more restricted in that in final position its coda consonant is either /n/ or /r/, as shown in (10a) (where the dots indicate syllable breaks). When closed by another consonant in final position a vowel is suffixed to that consonant, as shown by (10b). Furthermore, CVVC is never derived by any process, phonological or otherwise.

(10) CVVC in word-final position

a.	mbin. daan	'maid/butler'
	Hal. waar	'name of a village'
	mon. toor	'watch'
	dii. waan	'place/area'
	mi. soor	'headscarf'
	ti. su. baar	'prayer time'
	kaf. taan	'type of dress'
b.	tuu. baak-o	'European'
	European-Noun class agr.	
	ca. paat-o	'Moor/Arab'
	moor-Noun class agr.	

Syllable weight and the fact that CVVC is never derived is relevant to VD in that in a configuration like that shown in (7a-b) above where the vowel of the second morpheme is closed by a consonant (that consonant is moraic by virtue of the WBP rule that I mentioned earlier) the rule of deletion is going to avoid deriving a long vowel because this will result in a CVVC where the last /C/ is moraic; therefore a trimoraic structure, violating thus the upper limit of two moras per syllable in Pulaar. This is not to say that CVVC is always trimoraic. In fact it is my claim that non-derived CVVC is not trimoraic and here is the evidence. If CVVC were to be treated as trimoraic then when its coda consonant is deleted one would expect compensatory lengthening to take place and derive a triply long vowel. This does not happen. For instance, the Arabic word /Wallaah/ has been borrowed into Pulaar; but when the /h/ got deleted (because of the restriction I discussed above against coda /h/) what we have is /wallaayi/ instead of */wallaaa/, which is expected if CVVC syllables were treated as trimoraic by Pulaar speakers (Cf. Diop (1993) for more discussion).

The next issue is that of glottal insertion. In Pulaar, vowel-initial morphemes trigger a glottal insertion. Major lexical category items (nouns, adjectives, adverbs, and verbs) systematically do so. For example, in the data in (11a) below the

words are underlyingly vowel initial. However, each of them is pronounced with a glottal stop before the initial vowel, as illustrated by (11b).

(11) Vowel-initial words in Pulaar

a.	ekk-o	'apprenticeship'
	am-re	'turtle'
	in-nde	'name/naming ceremony'
	oto	'car'
	uur-de	'to smell good'
b.	ʔekko	
	ʔamre	
	ʔinnde	
	ʔoto	
	ʔuurde	

What is then the relevance of this to VD? The answer is a question. If vowel-initial words are realized with a glottal stop on the surface, why then would the vowels of morphemes like /e/, /on/, /a/, /en/, etc. in (6)-(8) above be syllabified with the final syllable of the preceding morpheme? Therefore, one would have to say that glottal insertion affects only major lexical category items such as nouns, verbs, and adjectives. That is not quite adequate because the morphemes whose (initial) vowel gets resyllabified with the previous morpheme, when they appear in sentence-initial position are also pronounced with a glottal stop. So, /a/ (you-singular) in the sentence /a-jal-ii/ 'you-laugh-ed' is pronounced /ʔa/. Glottal insertion will then be permitted even with lexical categories other than nouns, verbs, and adjectives if those are in sentence-initial position.

The next and last issue has to do with a proposal (Diop (1993), cf. same reference for more discussion) that moraic phonology have a rimal tier. Thus, (12a-c) show, respectively, the representation of a short vowel (/o/), a long vowel (/oo/), and a vowel-glide sequence (/oy/) within the different syllable-internal nodes assumed in this paper (only the relevant part is shown for each representation). (12c) illustrates the fact that I treat the vowel-glide sequence as being the direct 'product' of syllabification whereby the first vowel is syllabified in the nucleus whereas the second vowel is syllabified outside it. (12d) will be ruled out as a possible representation for /oo/ because it is a violation of OCP (McCarthy 1986; Hayes 1986; Odden 1986).

(12) Syllabification of vowels and vowel-glide sequences
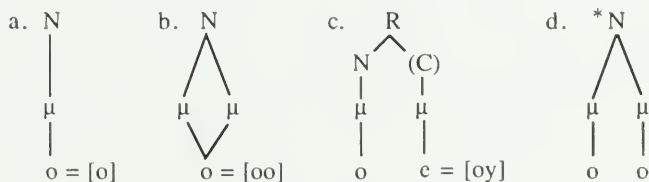
In the foregoing I have discussed some background information pertinent to the analysis of VD in Pulaar. Here is, again, a summary of the patterns observed so

far in (6)-(8) (overlooking the rather unproblematic case of (8e)). We had a pattern deriving a long vowel from two short identical vowels. A long vowel was also derived when we have a vowel preceded by a high (or high and long) vowel. Another case where the rule yielded a long vowel is when /a/ was preceded by /o/.

The second pattern was when the vowel of the second morpheme was closed by a consonant; syllabifying that vowel with the preceding morpheme produced a short vowel (and a consonant) rather than a long one.

The third pattern was that in which a vowel-glide sequence was created. In that pattern, for the /VW/ sequence we had the combinations in (13a) whereas for the /VY/ sequence the combinations are illustrated by (13b) below.

(13) Vowel-glide sequences in Pulaar: a reminder

    a. V-W sequences

        /a/ + /o/   = /aw/

        /e/ + /o/   = /ew/

    b. V-Y sequences

        /a/ + /e/   = /ay/

        /o/ + /e/   = /oy/

The challenge presented by the data for any analysis of vowel deletion would to predict each of the different outcomes just outlined. Furthermore, in (6e) above we have a case where a short vowel (monomoraic) spreads to a position previously occupied by a long one (bimoraic). Yet we do not get a trimoraic syllable. What we derive is a long (bimoraic) vowel. One has to account for what happened to the third mora. This case is somewhat similar to that in (7a-b) where a trimoraic structure is also reduced to a bimoraic one. But, as we shall see, they are treated differently. Another challenge for any analysis of VD would also be to predict the occurrence of vowel-glide sequences. In the section to follow I am going to give the solution that I propose for VD.
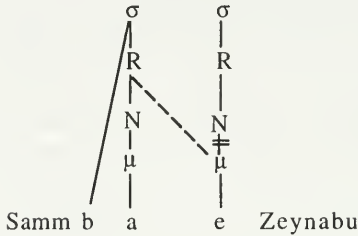
3. A phonological analysis of vowel deletion in Pulaar

In (5) above I gave a representation of Pulaar vowels and a redundancy rule that captures the fact that the feature [back] is predictable in Pulaar. Given the Pulaar syllable facts I outlined at the beginning of the paper I also take it to be the case that syllable structure is assigned lexically and post-lexically. Thus, following the operation of certain phonological or morphological rules the output of such rules can feed syllabification. Syllabification can take place across morpheme boundaries. So, in (8f) for instance, the conjunction /e/ 'and' is pronounced with the final consonant of the previous morpheme (i.e. /n/) as its onset; yet these two segments came from two different morphemes. My analysis, however, focuses more on the cases where two vowels (instead of a consonant plus vowel) merge. In such cases VD takes the form of a rime merger that is illustrated in (14) below. Referring to the syllable to account for phonological processes involving vowel mergers is not a novel idea. It has been proposed in Schane (1987). Although Schane's framework and the one I propose here have some similarities they differ in ways that I do not intend to discuss in this paper since it is not my intention to

compare the two frameworks. Nevertheless, I will spend some time summarizing Schane's theoretical framework. Schane's framework (which he uses to analyze hiatus in Sanskrit and Chicano Spanish) is one in which the autosegmental representations contain three tiers: a syllable tier, a CV tier, and a segmental tier. The first tier depicts the number of syllables while the second gives information about the quantitative characteristics of phonological units. The quality of the phonological units is determined by the third tier. In addition to these tiers Schane uses the notion of closure (merger) at each of these tiers. In the framework that I propose syllable count is not regarded as crucial. The quantitative characteristics of phonological units is determined by the mora whereas the rime and nucleus node determine the quality of phonological units. So, any phonological unit couched within the nucleus is going to be realized as a vowel whereas anything outside the nucleus is going to have consonantal status. As I said earlier the rule is formulated in terms of a rime and nucleus merger. The first rule (the rime merger rule), responsible for glide formation, because it has a more specific environment, is going to apply first following Kiparsky's (1973b; 1982a) Elsewhere Condition. It is illustrated in (14a) where it takes the initial vowel of the second morpheme and syllabifies it at the rime node level of the preceding syllable, giving a vowel-glide sequence for reasons that I explained earlier. (14c) is a derivation illustrating (14a) whereas in (15) we have the general rule that syllabifies vowels under the nuclear node. It accounts for the more general cases, (6)-(7). The delinking of the association line in the second syllable causes that syllable to collapse, making its rimal content available for the merger. As a reminder, the combinations that yield glide formation in Pulaar are shown in (14b). The generalization was that we get glide formation if a non-high non-low vowel is preceded by a non-identical non-high vowel. When such is the case the rime merger rule in (14a) syllabifies the second vowel within the rime of the first syllable, turning it into a glide. There is no contrast between high and mid glides (at least in Pulaar). Whether we get the labial glide /w/ or the palatal glide /y/ depends on the rounding specification of the second vowel. Where that specification is [+] we get /w/; and we get /y/ where it is [-]. In (14c) we give a derivation for /Sammbay Zeynabu/ < /Samba e Zeynabu/ 'Sammba and Zeynabu'. (14d) shows the surface representation of (14c). (Only the relevant parts are syllabified for /Sammba/.)

(14) Pulaar rime merger: a two-step process
        a. The specific rule: glide formation: rime merger

b. Pulaar glide formation

$$a + \varepsilon = /ay/ \qquad \qquad \mathfrak{o} + \varepsilon = /\mathfrak{o}y/$$
$$a + \mathfrak{o} = /aw/ \qquad \qquad \varepsilon + \mathfrak{o} = /\varepsilon w/$$

c. Derivation for [Sammbay Zeynabu]:

Samm b   a   e   Zeynabu

Glottal insertion   _____
rime merger: specific applies
rime merger: general   _____
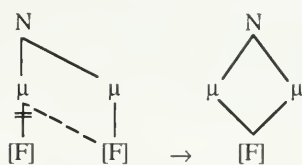
d. Surface representation of (13b) above:

Samm b   a   e   Zeynabu   = [Sammbay Zeynabu]

Having illustrated how the glide formation takes place I am now going to account for the general case: short/long vowels. The merger rule in (15a) below (ordered after (14a)) syllabifies the second vowel under the nuclear node. Following that we have a deletion rule (affecting the first vowel) and a root node spreading rule from the second vowel to the position formerly occupied by the first vowel. This second rule affects not only cases where the vowels involved are not identical but also those cases where they are in fact identical (in the latter case the rule may be considered as having the same effect as OCP). As said earlier, a set of vowel features on two (adjacent) moras under the same nuclear node gives a long-vowelled nucleus. The deletion and spreading rules are shown in (15b) below whereas (15c-d) show the derivation for [lewree koode] < /lewru e koode/.

(15) The Elsewhere rule:
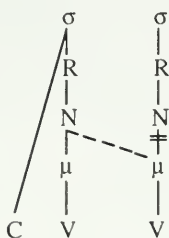
a.   nucleus merger   b.   Feature deletion and root node
                                  spreading (FD and RNS)

(where [F] is the root node)

c. Derivation for [lewree koode] < /lewru e koode/
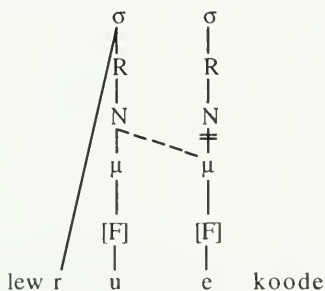
Specific rule   _____
General rule   applies
FD and RNS   applies
Syllabification   applies

d. Surface representation of (15c)
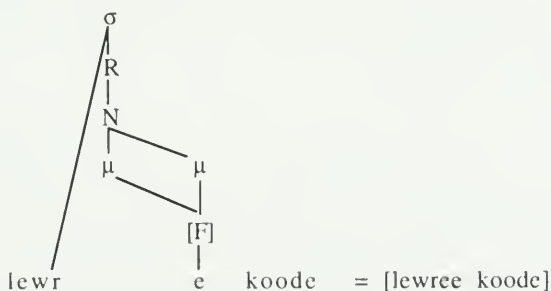
So far I have accounted for two cases: cases where VD yields a long vowel and those which yield a vowel and a glide. I now go on to the third case, i.e. where a short vowel results from VD. The relevant data are in items (7a-b) above

and they are reproduced here as (16a) for convenience (the target vowels are bold). In (16a) we have a monosyllabic (and closed syllable) pronoun /on/. The initial vowel of the second morpheme and the final vowel of the first are identical. Still, a long vowel is not produced. There are at least two ways in which the data in (16a) can be explained. The first tack we can take is as follows. Assuming that there is syllable structure prior to and following VD, also taking into account the fact that the WBP rule applies in Pulaar, the relevant part of (16a) can be represented as in (16b).

(16) a.   o-wii-**ko-o**n-njah-ii   →   ʔo wii kon njahii
           3sg-say-that-2pl-go-Asp   *koon
           'he said that you went'

      b.
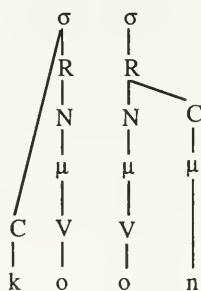
To the second syllable of (16b) we cannot apply glottal insertion because the morpheme is neither sentence-initial nor a major lexical category item. So, it is syllabified with the preceding syllable, causing a trimoraic structure. This structure is reduced to two moras (by virtue of a mora deletion rule that applies whenever a trimoraic structure is created) because Pulaar avoids trimoraic syllables (as said earlier), and never derives them.

This solution is not all that desirable (though probably unavoidable in some cases; as will be shown later) as it relies on something that does not look quite natural in phonological theory, creating a structure and then erasing it in order to arrive at the correct derivation.

We can do away with such an intermediary stage that creates three moras. The second approach is going to do just that; and for that reason it is the approach we adopt here. In this approach the syllable of the second morpheme /on/ (prior to the application of the rime merger process) collapses following the delinking of the association line from the mora to the nuclear node because a Pulaar syllable can only exist if it has a nuclear mora (i.e. a mora dominating a vowel). The mora of the nasal, naturally, is 'deleted' because at that stage there is no syllable structure and the nasal is no longer in rime position to receive a mora by virtue of the WBP and there are no syllabic nasals in Pulaar. The steps just outlined are illustrated in (17a-b) below. At this point in the derivation we proceed with syllabification. Following the rules that we postulated earlier ((14) above) the vowel of the second

morpheme is syllabified in the nucleus node of the final syllable of the first morpheme. So, it is the general, not the specific one, that applies. Feature deletion and root node spreading apply, as illustrated by (17c) below.
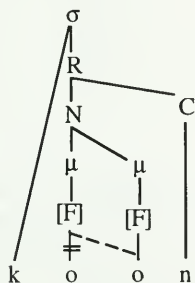
(17) Syllable 'collapse'
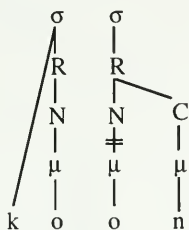
Earlier, I claimed, without elaborating on it much, that in Pulaar a consonant in coda position must be moraic. A piece of evidence for that was that long vowels shorten before CVC syllable in the same way they do before CVV(C) ones. However, WBP can only apply if its application does not violate the upper bound limit of two moras per syllable. Therefore, in (16c) WBP cannot apply. Since WBP cannot apply the second mora is then donated to the rimal consonant leaving the first vowel with one mora (therefore realized as a short vowel). This way we derive a bimoraic single short vowel syllable. In (18a) (next page) we illustrate mora donation whereas (18b-c) (next page) show the last and final steps of the derivation, including mora donation.

I have just given an account of how VD works when the second vowel-initial morpheme involved in the process is monosyllabic. Vowel-initial bisyllabic pronouns show similar behavior to that of monosyllabic pronouns in that when their initial is syllabified with the previous morpheme a short, not a long, vowel is derived. These pronouns, illustrated in (19) next page, are problematic for the analysis given for the monosyllabic pronouns in that while in the data in (16-18) we had single syllable morphemes (pronouns), in (19) we have bisyllabic morphemes as the second morpheme (e.g. /oɗon/). Following the syllabification

(18) a. Mora donation
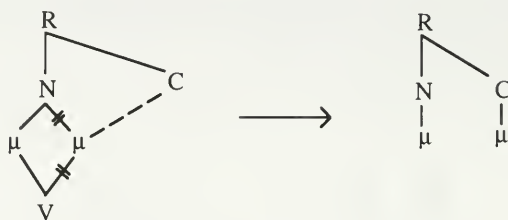
b.

c.
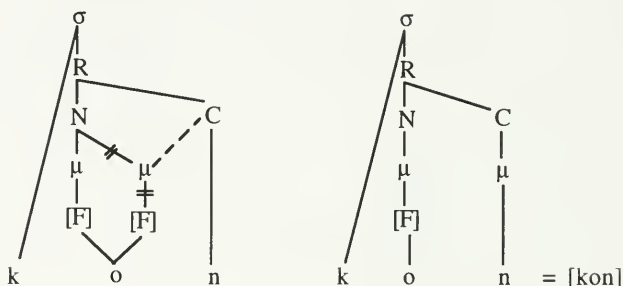
principles (both universal and parametric), the medial consonant in /oɗon/ is syllabified as the onset of the second syllable instead of the coda of the first. Consequently, it is mora-less. Therefore, the first syllable is monomoraic. Merging it with the preceding monomoraic syllable should not lead to any mora deletion or donation of some sort since bimoraic syllables are accepted in Pulaar. The issue, then, is whether the approach used to explain the data in (16-18) can be improved to accommodate the data in (19) or whether a whole new approach is needed for the new set of data. Clearly the latter is not desirable. We do not want to have a multitude of different rules and approaches to account for what might be one and the same phenomenon. We adopt the first suggestion then; i.e. improve the first approach in order for it to explain the data in (19). (Once again, whether the two vowels involved in the process are identical or not is irrelevant because we are always going to have a short vowel.)

(19) Bisyllabic pronouns and VD
     a.   o-wii-ko-oɗon-njar-a   =   o wii koɗon njara
          3sg-say-that-2pl-drink-Asp   *kooɗon
          'he said that you drink'
     b.   ɗo-omo-yah-a-fof   = ɗomo yaha fof
          'pl.Adv-3sg-go-Asp-every'   *ɗoomo
          wherever s/he goes

    In order to put things into perspective a brief survey of Pulaar pronouns is necessary. (20a-c), (21), (22), and (23) illustrate these.

(20) Pulaar subject pronouns: the one-syllable set

    a. Preposed

	Singular	Plural
1	mi	en / min
2	a	on
3	o	ɓe

       Example

          mi-yah-ii   '1 went'

          1sg-go-Asp

  b. Postposed

mi	ɗen / en
ɗaa / aa	ɗon / on
---------	----------

       Example

          njah-mi   '1 went' (focus construction)

          go-1sg

  c. The two syllable set: never postposed

miɗo	amin / emin
aɗa	oɗon
omo	eɓe

       Example

          miɗo-yah-a   'I go' (habitual)

          1sg-go-Asp

(21). Object pronouns

kam / mi	men / en; min
ma / maa	mon / on
mo / moo	ɓe

(22). Independent/focus pronouns

miin	minen / enen
aan/maa	onon/mon
kanko/makko	kamɓe/maɓɓe

(23). Possessive pronouns

am	amen / men
maa	mon
makko / iiko	maɓɓe
/ mum / um	

In Pulaar /on/, /en/, /o/ and /a/ are subject pronouns. They correspond, respectively, to the second part of the two-syllable pronouns in (20c). The first part in each of these pronouns (i.e. /oɗ/, /eɗ/, /om/, /aɗ/) is neither a pronoun nor an attested (synchronic) prefix of some sort. All things being equal we take it to be the case that in each of the pronouns in (20c) a highly morphologized phonological rule suffixes the pronoun to a closed syllable 'morpheme'. That being said, we also take it to be the case that the rime merger rule will take place before this process of pronoun suffixation. This way the process in (20c) is similar to that in (16)-(18)

in that we have a closed-syllable vowel-initial morpheme (/oɗ/, /eɗ/, /om/, and /aɗ/) merging with a vowel-final syllable and the same solution (not repeated here) can account for both cases.

The solutions proposed so far seem to predict and explain the data presented thus far on VD in Pulaar. However, there is a set of data that seem to be problematic for our analysis. In (24a-g) below we have sentences in which VD could take place, given that the context of (14) above is met, but indeed does not. (A slash between two vowels indicates that the rule fails to apply and that the vowel is pronounced with a glottal stop.) The data are organized in pairs that show a contrast between two cases. On the one hand we have cases where the first morpheme ends in a long vowel that does not delete. The next example will show the same vowel at the end of a morpheme where that vowel is short. In that case the second vowel is syllabified with the first to form a vowel-glide sequence. This pattern is found, respectively, from (24a-f) where (a) contrasts with (b), (c) with (d), so on. (24f) illustrates the fact that long vowels at the end of a morpheme do indeed allow the rule to operate.

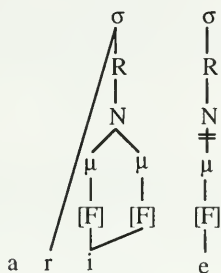(21) Vowel deletion and prosodic information

<blockquote>

a.   Muus**aa-/-e**-debbo-mum
    Moses-coord.-woman-his
    Muusaa and his wife
    =Muusaa ʔe debbomum   *Muusaay

b.   Rama-**e**-Abu
        coord.
    Rama and Abu
    = Ramay Abu

c.   njol-ɗ**aa-/-e**-oto-makko
    enter-2sg-prep-car-his/her
    you entered (in) his/her car
    = njolɗaa ʔe otomakko   *njolɗaay

d.   njol-mi-**e**-oto-makko
    enter-1sg prep car-his
    I entered (in) his car
    = njolmee otomakko

e.   Bus**oo-/-e**-sehil-mum
        coord.-friend-his
    Busoo and his friend
    = Busoo ʔe sehilmum   *Busooy

f.   Dono-**e**-miñ-um
    coord.-young-sibling-his
    Dono and his younger sibling
    = Donoy miñum

g.   mi-ar-**ii-e**-meere
    1sg-come-Asp-prep.for-nothing
    I came for nothing
    = mi aree meere

</blockquote>

Our hypothesis is that prosodic information is responsible for failure of the rule to apply in these cases. The explanation for the 'apparent' problem in (24) above is as follows. First, notice in Pulaar (as just said) that the initial vowel of a second morpheme can be syllabified with the final syllable of the previous morpheme even when the latter ends in a long vowel (cf. 24g). Second, notice also that in all the cases where VD fails to apply (namely, in examples (24a, c, and e) the long vowel of the first morpheme is either /a/ or /o/. As shown in (8) and (13) above, /a/ or /o/ + /e/ give, respectively, the sequences /ay/ and /oy/, a closed syllable. A sequence of one vowel and a coda consonant is treated as bimoraic in our approach to the Pulaar syllable. In the data in (24), where the rule fails to apply we have long vowels, instead of short vowels as host, except for (24g). So, in (24a) for instance we have /aa/ + /e/; which, in theory, should yield the sequence /aay/ (*Muusaay Abu). However, if this was to be the case we create a (superheavy) trimoraic syllable (viz. /saay/). As said earlier this type of syllable in Pulaar is not desirable (especially 'word'-finally); nor is it derived by any phonological process. The prohibition against trimoraic syllables acts then as a filter on all phonological operations that involve syllabification to the extent that it prevents one from deriving super heavy syllables. So, in (25) we have a case where /e/ could be brought under the rime node subject to being 'rejected' from under it by the moraic filter as its syllabification under that rime will create a trimoraic structure. Once it is 'rejected' from the previous syllable it has to form a syllable on its own, triggering thus the glottal insertion rule (mentioned earlier without much formalism) that provides a default onset to vowel-initial morphemes. Consequently, we have another environment where such glottal insertion takes place. First we said it took place sentence-initially. We have to add to that another environment; namely, after the application of the moraic filter (in phrase-initial position). To end this section I am going to present our analysis of the data in (24g). The problem presented by (24g) is as follows. The first morpheme has a long (therefore bimoraic) vowel. The second morpheme is a single vowel (monomoraic) syllable. Deleting the final (bimoraic) vowel of the first morpheme and spreading the second (monomoraic) one in this instance will inevitably give rise to a trimoraic structure, especially since the mora donation rule in (18a) cannot be applied here as there is no coda consonant to yield the third mora to (unlike the case of (17a) above). It looks, then, that in deriving (24g) we have to go through a stage at which a trimoraic structure is created. However, the difference between this case and the one in (17a) is that in the latter there was no reason to believe that the nasal carried a mora throughout the derivation because when the syllable structure in which it was found collapsed the mora was then lost because consonants only receive a mora by virtue of the WBP, in the theoretical framework that we adopt here.   In (24g) this argument cannot be made. Instead, we propose the following solution. First, some (by now familiar) assumptions. In Pulaar, there are no sequences of three vowels (or consonants), identical or not. So, this gap can be expressed in terms of a Pulaar-specific prohibition against ternary branching for vowel (consonant) features. In addition, the restriction against trimoraic structures in Pulaar (*σ+2μ, i.e. no syllable can have more than two moras) acts as a filter on all phonological operations involving syllabification to the effect that it prevents derivation of syllables that
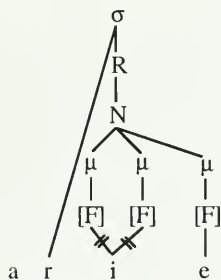
violate the upper bound limit of two moras per syllable. When this limit is violated it triggers a deletion of the third mora. In (24g) the issue will be to decide which mora to delete and how to make it candidate for deletion. (24g) has been repeated here as (25) as a reminder.

(25)   mi-ar-ii-e-meere   = mi aree meere
        1sg-come-Asp-Prep.for-nothing
        I came for nothing

                                          * areee

        To the vowel /e/ the glottal insertion rule fails to apply, so the rime merger rule (the elsewhere rule) applies syllabifying it under the nuclear node of the syllable containing the long vowel. Following this we apply the feature deletion rule deleting the features of the long vowel /ii/. We have, then, two moras without features. The root node spreading rule applies, spreading the features of the vowel of the second morpheme to one of the moras of alpha given that vowel features can only be binary branching, at the most. This leaves us with one mora that does not dominate any features. Ito (1986) introduced the notion of Prosodic Licensing that says that 'phonological material must be incorporated into the next higher level of prosodic structure'; otherwise, 'it is deleted by Stray Erasure' (Steriade 1982, Harris 1983). As mentioned by Hayes, 'a natural extension of this principle would state that higher-level phonological elements, such as moras, are also subject to Stray Erasure if they fail to dominate any lower-level element' (Hayes 1989:264). One of the moras of the host is exactly in that situation. Its features had been deleted by the feature deletion rule but it is not linked to any feature at the end of the derivation where syllabification takes place again. Therefore, we have a mora that does not dominate any features (vocalic or consonantal); so it is candidate for Stray Erasure. The mora deletion rule is illustrated in (26a) whereas the steps discussed so far are illustrated in (26b) below in a derivation for [mi aree meere] < /mi arii e meere/. Since the analysis here is quite complex (26b) will be done in five steps showing the different stages of the derivation and the surface representation. What (26a) says in essence is that a mora that does not dominate any segmental material is erased (since it would be impossible for it to be realized phonetically).

    (26) Trimoraic mergers
        a. Mora deletion

b. Derivation for [mi aree meere] < /mi arii e meere/
   (only the relevant parts /arii e/ are shown)

Step 1: syllable collapse   **Step 2:** nucleus merger

Step 3: feature deletion   **Step 4:** Root node spreading
                                         and mora deletion

Step 5: Surface representation

In the foregoing I have shown that the data in (24), which seemed to be problematic for my analysis turned out to be easily handled by it. I have, thus, accounted for what would have otherwise been considered exceptions to VD.

This is not all, however. We do have further cases where failure of the rule to apply cannot be attributed to prosodic information. I shall demonstrate that syntax is the reason for such failure. VD in Pulaar is sensitive to syntactic information in establishing its domain of application. In this last section we are going to try and

demonstrate that fact. First I present the data, followed by a presentation of basic facts about Pulaar syntax; then I present the syntactic structure in which the first and second morphemes are found; for instance /V-P/ meaning the first morpheme is a verb whereas the second is a preposition. I end this section by testing the data against two major approaches to syntax-phonology interface, the direct approach and the indirect approach, and showing that the generalization about the data escapes the predictions of either approach.

4. Vowel deletion and syntax

First, the data (a slash between two vowels indicates that the rule does not apply and the glottal stop with which the second vowel is pronounced in this case is shown when the example is repeated after the glosses).

(27) Vowel deletion and syntax

    a.   teew-ng**u,-/-a**-yiɗ -aa-ngu
           meat-NC-2sg-like-Neg-Respr.
           the meat, you don't like it
           = teew ngu, ʔa yiɗaa ngu   *ngaa

    b.   teew-ng**u-a**-yiɗ -aa-ngu
           meat-Rel.-2sg-like-Neg-NC
            the meat (that) you don't like
           = teew ngaa yidaa ngu

    c.   rawaa-ndu-nd**u-/-e**-joom-um
           dog-NCagr-NCDet.-coord.-owner-3sgPoss
           dog the and owner its
           the dog and its owner
           = rawaandu ndu ʔe joomum   *ndee

    d.   ndu-rawaa-nd**u-e**-joom-um
           NCDet-dog-NCagr-coord.-owner-3sgPoss
           this dog and its owner
           =ndu rawaadee joomum

    e.   nd**u-/-e**-joom-um
           NCDet-sing-coord-owner-3sgposs
           this (one) and its owner
           =ndu ʔe joomum   *ndee

    f.   gor-k-o-mo-calmin-m**i-/-o**
           man-ʔ-NCagr-Rel-greet-1sg-NC
           man that greet I the
           the man I greeted
           = gorko mo calmin mi ʔo   * moo

    g.   gor-k-o-mo-calmin-m**i-e**-mon-o
           man-ʔ-NCagr-Rel-greet-1sg-Prep.-2pl. NC
           man that greet I among you the
           the man I greeted among you
           = gorko mo calminmee mon o

h. o-rokk-**i**-/-**on**-jawdi
    3sg-give-Asp-2pl-wealth
    He gave you (pl.) wealth
    = o rokki ʔon jawdi   *rokkon

i. ko-/-enen
    foc.-1pl.
    It's us
    = ko ʔenen   *kenen

j. oto-**am**
    car-1sgPoss
    my car
    = otam

k. mo-/-**am**
    ʔof-1sgPoss
    that (of) my
    mine
    = mo ʔam   *mam

The data just introduced in (27) present some interesting and challenging problems. In the next paragraphs to follow I am going to outline what those problems are. First, (27a) and (27b) show that the morpheme /ngu/, a noun class in the first example and a relative clause marker (i.e. head of Comp) in the second, displays two different patterns in the sense of its vowel deleting in (27a) but not in (27b). (27c) and (27e) are other examples that illustrate a case of a noun class (or a determiner) whose final vowel does not delete whereas (27d), the 'mirror' image of (27c), shows that the final vowel of the head noun /rawaandu/ deletes. In (27f) we see that the vowel of the subject pronoun /mi/ does not delete when followed by the (open syllable) noun class (determiner of the head noun in the relative clause) whereas the same subject pronoun used in front of a following preposition /e/ (in (27g)) shows final vowel deletion. In (27h) the final vowel of the verb does not delete when followed by a vowel-initial object pronoun /on/ whereas earlier in (26b) we saw that final vowels of verbs can delete. In (27j) and (27k) we have another interesting alternation. In (27j) the vowel of the first morpheme deletes, allowing /am/ 'my' to be syllabified with it (cf./otam/) whereas in (27k) the rule is blocked between /mo/ and /am/.

The data presented in (27) show the first and the second morphemes (whose vowels are involved in the process of VD), occurring in the following syntactic configurations (28).

(28) Syntactic structures

Synt. Structure	Example number	rule applies?
NP-Conj	6a-b; 8a; 8f; 21b; 24f; 27d	yes
NP-Conj	24; 24e	no
C-NP	6c-d; 6f; 7a-b; 8c-d; 19a-b; 27b	yes
V-P	6e; 24d; 24g; 27g	yes
V-P	24c	no
NP-P	8b	yes

Det-NP	27a	no
Det-conj	27c; 27e	no
V-Det	27f	no
V-NP	27h	no
Focus-NP	27i	no
NP-poss	27j	yes
P-poss.	27k	no

Having presented the data, the nature of the alternations involved, and the syntactic configurations in which the two morphemes involved in vowel deletion occur, I am going to first outline some basic facts about Pulaar syntax before getting into the details of the analyses. In the basic word order of the Pulaar sentence subjects precede their predicate, objects follow verbs, as illustrated by (29) below.

(29) Pulaar basic word order
      mi-yar-ii-kos-am-hanki
      1sg-drink-Asp-milk-NCagr-yesterday
      'I drank milk yesterday'

The Pulaar noun typically has a root and noun class agreement attached to that root that shows what class the noun belongs to (cf. Paradis (1986, 1992); Sylla (1982) for detailed studies of Pulaar noun classes). For instance, in (27) below the word for dog /rawaa-/ belongs to the /ndu/ class in the singular and to the /ɗi/ class in the plural. Consequently, it bears /ndu/ or /ɗi/ on its root. We can also add to it the diminutives /gel/, /kon/, or the augmentative /gal/.

(30) The Pulaar noun

rawaa-ndu	rawaandu	dog
rawaa-ɗi	dawaaɗi	dogs
rawaa-gel	dawangel	small dog
rawaa-kon	ndawakon	small dogs
rawaa-gal	dawangal	big dog

Within the noun phrase the head noun (root + noun class agreement marker) is either in initial position followed by the noun class, as illustrated by (31a-b) below, or in phrase-final position preceded by the determiner (e.g. 'this'). (31c-d) is an illustration. The noun phrase can be null-headed, as illustrated in (31e) where /ndu/ is understood to refer to /rawaandu/ 'dog'. These null-headed NPs are represented in (31f).

(31) The Pulaar noun phrase
    a. Full NPs

rawaa-ndu	ndu	= rawaandu ndu
dog-NCagr	NC	
dog	the	
the dog		

b. Representation
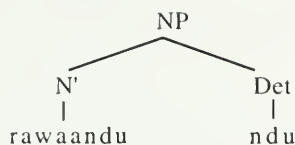
c. ndu-rawaa-ndu   = ndu rawaandu
    Det-dog-NCagr
    dog this
    this dog
d. Representation
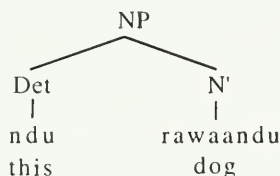
e. Null-headed NPs
    ndu-dog-ii   = ndu dogii
    NC(Det)-run-Asp
    it ran (away)
f. Representation of null-headed NPs
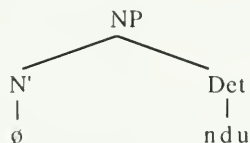
Relative clauses are formed by using the noun class of the head noun (as a relativizer) or by using /mo/ for nouns which belong to the /o/-class (of humans and borrowed words). However, this /mo/ can only appear when we have a negative relative clause, as in (32a-b). Positive relative clauses where the head noun is subject (instead of agent) do not allow use of the relativizing pronoun, as shown in (32c). Instead, the verb shows agreement with the head noun in the sense of bearing an agreement marker that corresponds to the head noun.

(32) Relative clauses in Pulaar
    a. gor-k-o-mo-yah-aan-i-o
        man-?-NCagr-Rel-go-Neg-Asp-NC(Det)
        man who go not the
        the man who did not go
    b. gor-k-o-mo-rokk-u-mi-ndiy-am-o
        man-?-NCagr-Rel-give-Epen.-1sg-water-NCagr-NC(Det)
        man who give I water the
        the man I gave water to.

    c.   gor-k-o-ñaam-ɗo-o
        man-ʔ-NCagr-eat-Agr-NC(Det)
        man eat the
        the man who ate
        * gorko mo ñaamɗoo

Verb phrases are somewhat complex. The verb precedes the direct object, indirect object, and the prepositional phrase. Verbal complexes may be formed of a root plus a number of extensions that are subject to both ordering and co-occurrence restrictions. There are two object pronouns /moo/ 'him/her' and /maa/ 'you-sing' that are internal to the verbal complex in the sense that they occur before the post-posed subject clitic which is also considered part of the verbal complex (cf. Paradis (1986, 1992); Prunet & Tellier (1984); Diop (1993) for further discussion). Other object pronouns are 'outside' the verbal complex in the sense of occurring after the postposed subject clitic. (33) below is an illustration of the different verbal complexes just mentioned.

    (33) Pulaar verbal complexes

a.	add-ii	= ʔaddii
	bring-Asp	
	brought	
b.	add-ii-jawdi	= ʔaddii jawdi
	bring-Asp-wealth	
	brought wealth	
c.	add-ii-e-jam	= addee jam
	bring-Asp-Prep.-peace	
	brought in peace	
d.	add-an-ii	= addanii
	bring-Ben.-Asp	
	brought for	
e.	add-an-oy-ii	= ʔaddanoyii
	bring-Ben.-Mvt-Asp	
	went and brought for	
f.	add-an-oy-moo-mi	= ngaddanoymoomi
	bring-Ben.-Mvt-3sgobj-1sg	
	I went and brought for him/her	
g.	add-an-oy-mi-on	= ngaddanoymi ʔon
	bring-Ben.-Mvt-1sg-2pl.obj	
	I went and brought for you (pl.)	

In focus constructions the focus marker /ko/ appears before the focused NP (cf. Sylla (1982) for further discussion). If the NP is a pronoun then it has to be from the set given in (20c) or (22) above. Pronouns from those two sets always precede the verb. They are never postposed. (34) below illustrates focus constructions.

    (34) Focused NPs in Pulaar

a.	ko aan	= ko ʔaan
	It's you	

b.   ko-aan-e-makko   = ko aane makko
        foc.-2sing-Conj.-3sg
        It's you and s/he
c.   ko-aan-e-makko-yah-i-e-oto
        foc.-1sg-Conj.-3sg-go-Asp-Prep.-car
        It's you and s/he went in car
        It's you and s/he who went by car
                                    = ko ʔ aane makko njahee ʔoto

Having presented the basic picture of Pulaar word order that is relevant to vowel deletion I am now going to discuss the two approaches to syntax-phonology interface. As I discuss each approach I will test it against the data given so far and point to the problematic cases. First, the direct-syntax approach (DSA, henceforth).

4.1. The direct-syntax approach. (Clements 1978; Kaisse 1985; 1987, 1990; Odden 1987).

In this approach an external sandhi rule applies between a sequence of two words α and β when it is the case that either the two belong to the same X^{max} or if some c-command relation holds between α and β, depending on what version of c-command one adopts. Two versions of c-command prevail. They are presented in (35) below (Sells 1985:39).

(35) C-command
        α c-commands β iff:
        a. every branching node dominating α dominates β
        b. every XP dominating α dominates β

Under definition (35a) V in (36a) below c-commands NP but not PP whereas under (35b) V c-commands both NP and PP. By the same token NP c-commands P of PP in (36b) only by virtue of (35b) (as illustrated by the arrows).

(36) C-command illustrated
        a.
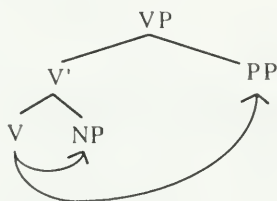
b.
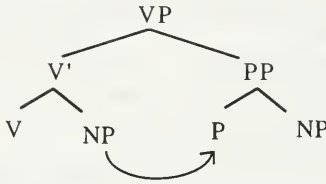
Given these two notions of c-command I am going to discuss what the predictions the direct access approach are going to be with respect to the Pulaar data. First, the simple cases. Assuming the c-command notions in (35) (within the DSA) we can formulate the rule of vowel deletion as in (37).

(37) Vowel deletion in Pulaar: preliminary version
Delete the final vowel of a word when it is followed by a
vowel-initial word that it c-commands.

The rule in (37), using either version of c-command, is going to easily predict the data illustrating noun coordination where the first NP is not branching, therefore not necessarily dominated by XP. The same holds for cases where we have a CP whose head (C) is in a c-command relation with the specifier of the following IP. These two cases are schematically illustrated in (38a-b), respectively, whereas (39) gives a representative sample of the data presented earlier. (Throughout the rest of this section of the paper an arrow between two constituents means that the rule operates between them whereas a barred arrow means that the rule is blocked.)

(38) Predictions of the DSA
a. Coordination (Jackendoff 1977:190)

a man and a woman
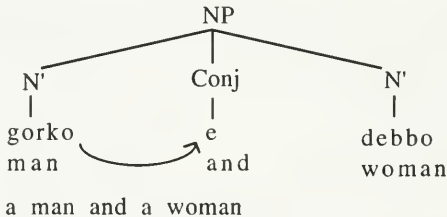
Data that fit this pattern are presented in (6a-b);
(8a, f); (24b, f); and (27d);

b. CPs

```
              CP
          /        \
        C            IP
        |         /     \
        |       NP        VP
        |       |        /‾‾\
       m o      a       yiy-aan-i
      that     you     see-neg-Asp
```

that you did not see
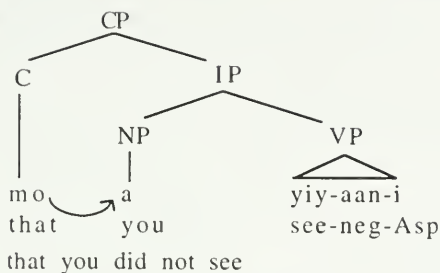
Data that fit this pattern are illustrated in (6c-d, f);
(7a-b); (8c-d); (19a-b) and (27b).

The rule in (37) also predicts (using either version of c-command) the data in
which a verb(al complex) is followed by a preposition. The data are in (6e), (24d,
g), and (27g) above and the relevant trees are drawn in (39a-b) below where the ar-
row shows the rule operating. In (39b) the rule operates between the verbal com-
plex (verb root + postposed subject pronoun) and the following pronoun.

(39) Further correct predictions of c-command
  a.

```
              VP
          /        \
        V            PP
        |          /     \
        |         P        NP
      ar-ii       e       meere
     come-Ap    prep.    nothing
```

come for nothing

  b.

```
              VP
          /        \
        V'           PP
        |          /     \
        V         P        NP
       /‾‾\       |         |
     calmin-mi    e        mon
      greet-I    prep.     you
```

I greeted among you
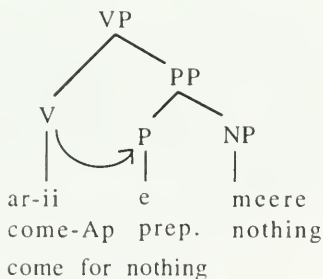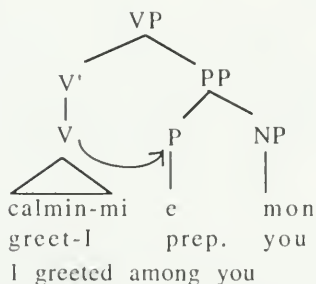
In addition to these data the rule in (37) correctly predicts that deletion (and
spreading) do not occur in (27a, c, f). In all these data c-command does not hold

between the two morphemes involved, no matter which of the two versions in (35) above one is adopting. So deletion is blocked because the morphemes are not within its domain. In (40a-c) below I draw trees for (27a, c, f), respectively, to illustrate failure of c-command to hold.

(40) More predictions of the DSA

a.

the meat, you don't like it

b.

the dog and its owner

c.

gor-k-o-mo-calmin-mi-o
man-ʔ-NCagr-Rel-greet-1sg-NC
the man that I greeted
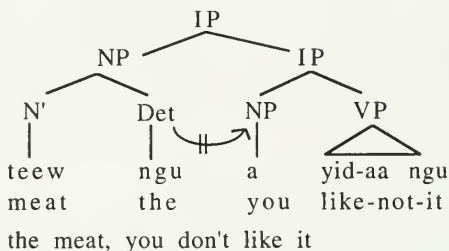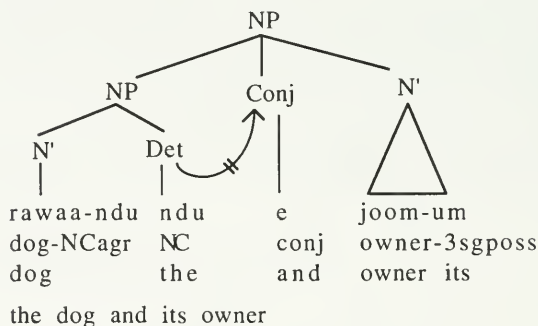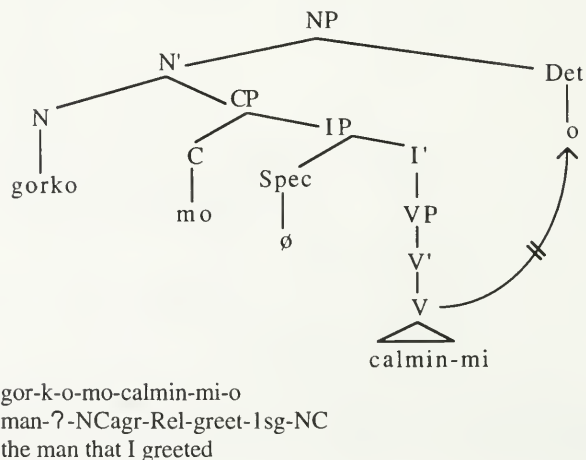
As shown by the trees in (40a-c) above c-command does not hold in (40a) between /ngu/ 'the' and /a/ 'you-sing.' since the first element is dominated by a branching maximal projection (NP) that does not dominate the second element /a/. In this case neither version of c-command is satisfied; so the two morphemes fall outside the domain of vowel deletion. The same reasoning holds for (40b) where the determiner /ndu/, daughter of a branching maximal projection, cannot c-command the following conjunction /e/. In (40c) we see that clearly the pronoun /mi/, which is internal to the verbal complex cannot under any of the versions outlined above, c-command the determiner /o/. So, deletion is expected not to take place there either. Another correct prediction that (37) makes is (27j) where we have a noun followed by a possessive pronoun /am/. Both of these are within the same branching maximal projection; so either version of c-command holds for them, as shown in (41) below.

(41)

```
              NP
          ╱       ╲
        N'          Poss
        |            |
       o t o        a m
         ╰──────────╯
```
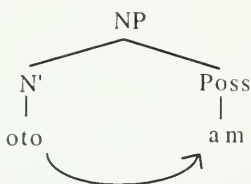
However, looking further into the data in (27) we can see that the rule in (37) gets in trouble with (27e, h, i, k). In (27e) the final vowel of the first element in an NP coordination does not delete whereas it did in (6b), or it fed glide formation, as in (8a). (42a) below is a possible representation for (27e). In this representation c-command holds between /ndu/ and /e/ assuming either version; yet the rule fails to apply. (42b-d) illustrate trees for cases (24)h, i, and k where the rule also fails to apply despite the fact that c-command holds.
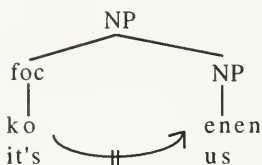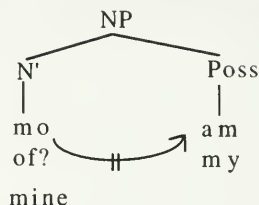
(42) Problematic cases for c-command

a.

```
                    NP
              ╱      |      ╲
            N'      Conj      N'
            |        |       ╱╲
          n d u      e     joom-um
          this  ╫  a n d   owner-its
```
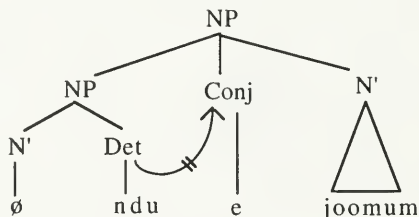
this (one) and its owner

b.


```
            IP
          /    \
       NP       VP
       |       /  \
       o      V     NP
     s/he     |     |
          rokk-i    on
          give-Asp  you-pl
        she gave you
```

c.   d.


```
        NP                              NP
       /  \                            /  \
    foc    NP                       N'     Poss
     |     |                        |       |
     ko    enen                     mo      am
    it's   us                       of?     my
                                   mine
```
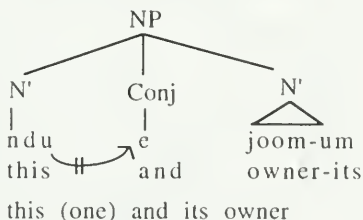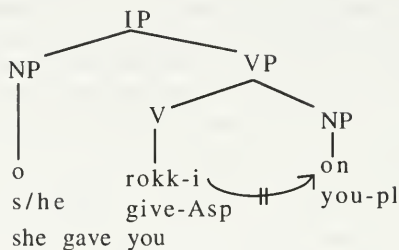
In all these cases c-command holds but the vowel of the first word is not deleted and the initial vowel of the second morpheme is, consequently, realized with an initial glottal stop. However, there is a way in which (37) can account for these data without any additional stipulations to the rule. It is as follows. In (42a) /ndu/, as a determiner, is not the head of the NP. It refers to a noun belonging to the /ndu/ class, e.g. /rawaandu/ 'dog'. The head, in this case, is missing. Therefore, what we actually have in (42a) is a case of a null-headed NP of the kind introduced in (31f) above. This being the fact, the syntactic representation of (27e) is one in which the first member of the coordinate structure is a branching NP that lacks a head, as il- lustrated in (43) below. In this case c-command does not hold and the data are ac- counted for by the rule in (37), as was the case for (40b) above.

(43) Further predictions of c-command


```
                  NP
              /    |    \
          NP      Conj    N'
         /  \      |       /\
       N'   Det    e      /  \
       |     |           joomum
       ø     ndu
```

The case illustrated in (42b) above can also be accounted for if we assume the fol- lowing facts. As mentioned earlier, (cf. Prunet & Tellier (1984); Paradis (1986, 1992) for discussion) while postposed subject pronouns are considered part of the verbal complex, object pronouns (with the exception of /maa/ and /moo/) are viewed as being outside it. One of the arguments used for this analysis of Pulaar
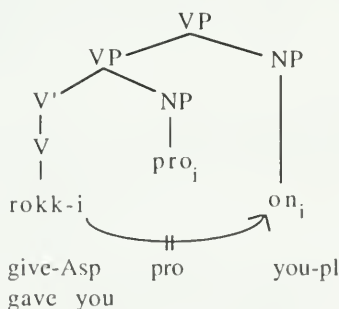
verbal complexes by the above-mentioned authors is the fact that subject pronouns cause the preceding long vowel within the verbal root to shorten whereas object pronouns do not have such effect. Furthermore, they also contend that a high vowel from a subject pronoun will cause preceding mid vowels from the preceding verb root to undergo ATR harmony whereas high vowels from the object pronoun do not cause ATR harmony in verbal roots. So, a verbal complex followed by a subject pronoun can be represented as in (44) below.

(44) Verbal complexes in Pulaar

```
        VP
        |
        V'
        |
        V
       /___\
    rokk-u-mi
    give-epen-1sgSubj
    I  gave
    =  ndokkumi
```
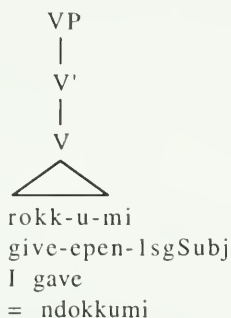
Since object pronouns do not form a constituent with the preceding verb they cannot be represented as in (44) above. So, my analysis is that they were moved from that position to a position outside V' (by application of the general rule Move-α; cf. Chomsky 1986), as shown in (45) below where pro is coindexed with the NP object pronoun that has been moved. In this configuration V does not c-command the following NP and deletion is not supposed to occur as the two elements /rokki/ and /on/ fall outside the domain of vowel deletion.

(45) Pulaar object pronouns: a syntactic representation

```
              VP
           /      \
        VP          NP
       /   \
     V'      NP
     |        |
     V       pro_i
     |
   rokk-i              on_i

   give-Asp    pro    you-pl
   gave  you
```

The arguments that lead to (46b) below are similar to those used to arrive at (43) above. Therefore it is not necessary to repeat them all. What is of most relevance here is the fact that in a construction like (42d) above the 'complementizer' that is used for relative clause formation is used before the possessive pronoun despite the fact that a relative meaning is not necessarily implied. That same complementizer

is also used in constructions such as 'of + place name' as in (46a) below. So, /mo/ whose meaning is something close to 'of' is analyzed as a determiner. In this case it is part of a branching NP whose head is null, as illustrated in (46b) below. In this configuration c-command does not hold and the data are predicted by rule (37) above.

(46) a.   gor-k-o-mo-Dimmbee Jooro
             man-ʔ-NCagr-of-Dimmbee Jooro (name of a city)
             the man from Dimmbee Jooro

     b.
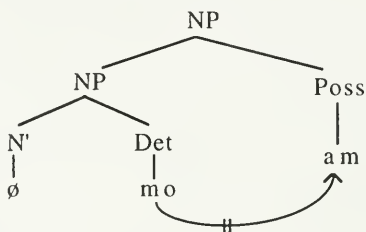
The data in (27i), represented in (42c) are a bit different in that we have a focused NP. In this case the explanation for failure of the rule to apply could be as simple as saying that focused NPs are promoted to the category of major lexical item and, therefore, behave like verbs, adjectives, or nouns whose initial vowel never participates in the process of vowel spreading.

So the rule in (37) seems to be able to account for all the data discussed so far. However, (37) along with the c-command versions assumed in (35) above incorrectly predict vowel deletion to be blocked in (27d) which is reproduced here as (47a). In (47) we have a branching NP (/ndu rawaandu/ 'this dog') the head of which is vowel-final. The rule applies to that head although it does not c-command the following conjunction, under either version in (35), as illustrated by (47b).

(47) C-command from branching structures
     a.   ndu-rawaa-ndu-e-joom-um
             Det-dog-NCagr-Conj-owner-its
             this dog and its owner
   = ndu rawaandee joomum

     b.
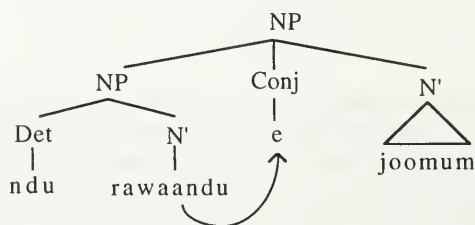
The problem is that Pulaar is full of cases like (47a) above. It is not the case that they are just a handful of exceptions that can be dealt with by adding some diacritic to the rule in (37). In fact it is not easy to imagine a proviso that can be added to (35) or (37), that is consistent with the different theories of c-command in the literature. In (47) there is both a maximal projection and a branching node that intervenes between /rawaandu/ 'dog' and /e/ 'and'. So, neither c-command nor government is supposed to hold between these two constituents. Therefore, although (37) handles all the data presented it cannot account for (27d) and the many instances of similar coordination. In such structures the first head noun has a determiner and is, consequently, daughter of a branching node. Thus, it cannot c-command the following constituent. In the next section I am going to analyze the data within the indirect access (also call the end-based theory) framework with a view to showing that it too cannot 'straightforwardly' render certain facts of VD in Pulaar. First, a look at the basic tenets of the end-based theory.

4.2 VD in Pulaar and the end-based theory (Selkirk 1984, 1986, 1987)

Within this approach to domain definition there are two important notions that play a crucial role in 'the mapping of syntactic representation into that hierarchy of prosodic domains which forms the essential constituency of phonological representation' (Selkirk 1987:152). First, the notion of Designated Category (DC). This notion has to do with the idea that for each prosodic category P_i 'there is a single designated category in the syntax with respect to which phonological representation at level P_i is defined' (Selkirk 1987:152). Selkirk argues that the basic X-bar levels in syntax, along with Government (more specifically L-governed/non-L-governed; cf. Selkirk (1982) for more discussion) determine the different designated category types. So, a designated category could be X^0, X', or X''/XP (i.e. a maximal projection). The second notion for the end-based theory is the End Parameter according to which only one end of a given designated category within the X-bar hierarchy is 'relevant in the formation of a prosodic constituent P_i: a P_i is claimed to extend from one instance of the appropriate end (R/L) of the DCi to the next (or failing that to the limit of the sentence) (Selkirk 1987:152).

Thus, in (48) below, where it is the designated category is XP and the end parameter is left, all three NPs constitute three separate domains on their own whereas V is not a domain (because not an XP) though it may be part of the domain of the NP to its left:

(48) XP/ L
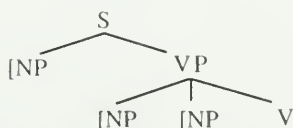
If the right edge were to be the parameter then the V would not be within the domain of any of the NPs in (48). It would form a domain on its own. If we change

the designated category in (48) above from XP to X and the end parameter to L (left), then V would be in a domain separate from that which contains the two NPs containing it. If the end parameter is R (right) then V and both NPs preceding it would be in the same domain.

The Pulaar data that I have presented so far establish the fact that when two morphemes (the first one vowel-final and the other vowel-initial) are within the domain of VD, deletion of the final vowel of the first morpheme is followed by a rightward spreading of the initial vowel of the second morpheme. Throughout the data one can also establish that the first morpheme within the domain of VD is typically the host in the sense of its final vowel undergoing deletion and in terms of it hosting spreading from the next morpheme's vowel. Let us also assume for the sake of the argument that the prosodic category P_i here is the phonological word. The parameters for VD in Pulaar can be set as in (49a) where the designated category is XP and the end-parameter is L (left). What (49a) says is to insert a bracket to the left of each maximal projection, in which case anything to its right will be included within the same domain (P_i) up to the next maximal projection or to the end of the sentence. To test (49) against the data presented in this paper I start, first, with coordination. Given the representation of coordination that I gave in (38) where neither head is dominated by a maximal projection (49a) correctly predicts that the first head and the conjunction are going to be within the same domain, as shown in (49b) below.
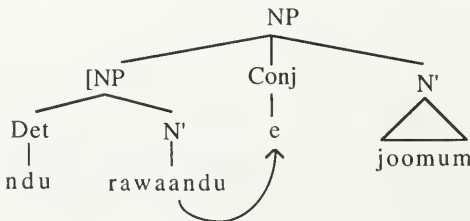
(49) Parameters for VD: the left edge
    a. XP/L
    b.
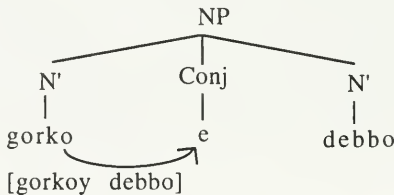
(49) also correctly predicts cases where the first noun in a coordinate structure is dominated by a (branching) maximal projection, as in (47b) above repeated here as (50) below.

(50)

In this and similar cases the first NP and the following conjunction form the same domain and VD applies. (49) also correctly predicts cases such as (41) where a noun forms a domain with the following possessive pronoun because they are both dominated by the same maximal projection. Furthermore, (49) also correctly predicts VD to be blocked in (40a) because the subject pronoun /a/ is dominated by a maximal projection and is, therefore, the beginning of a domain. Consequently it is within a separate domain from that containing the vowel-final /ndu/. Other data that (49) can easily accommodate are illustrated by (45) where a verb is separated from the following object pronoun by two maximal projections at the left of which a bracket is inserted to start a domain. VD is expected not to apply in this environment. In (42a) (49) also makes the correct prediction since a bracket is going to be inserted to the left of the NP dominating /enen/, putting it in a separate domain from the preceding focus marker.

As one can see (49) can account for a large body of data on VD. However, it is not general enough to handle a considerable amount of cases. In the following I discuss these. In (38b) the subject pronoun /a/ and the preceding complementizer are within the domain of VD because what native speakers say is /maa yiyaani/ < /mo-a-yiy-aan-i/ 'that you see-not-Asp'. The subject pronoun is dominated by NP and is expected to form the beginning of a domain separate from that containing the complementizer; and that is exactly the wrong prediction. Likewise, in (39a-b) the algorithm in (49) wrongly predicts that the preposition /e/ is going to form a separate domain from the preceding verb because the preposition is dominated by a maximal projection (PP) the left of which is a domain break that puts /e/ in a separate domain from the preceding verb. (49) also wrongly predicts that in (40b) /ndu/ (dominated by NP) and the following conjunction are going to be within the domain of VD. Likewise, it also predicts that in (40c) the verbal complex (dominated by VP) is going to group with the following determiner /o/. This is wrong. (49) gets in trouble further with (43) where it wrongly groups /ndu/ (dominated by the left NP) with the following conjunction within the same domain. The same problem arises with (46b). Therefore, if we maintain (49) we are going to have to explain all these exceptions. Instead of doing that let us set the parameter as in (51) where the Edge Parameter is set at R (right); everything else is going to remain the same as in (49).

> (51) Parameter for VD: the right edge
> XP/R

(51) inserts a bracket to the right of a maximal projection. Everything within that maximal projection falls within the domain of VD up to the next maximal projection or the end of the sentence. I assume the syntactic representations found in (38)-(50) above to be representative of all the data presented in this paper. Given that assumption (51), as will be shown shortly, makes the correct predictions for all the data except for three cases: (42c-d) and (47). I will first demonstrated the non-problematic cases for the right edge, mentioning, where appropriate, the cases that do not discriminate between (49) and (51); then I discuss the problematic cases.

In (38) above rule (51), just like (49), makes the right prediction since the same NP dominates /gorko/ and the following conjunction. (51) is able to account for the data in both (38b) and (39a-b) whereas these cases were problematic for (49). (40a) is unproblematic for both (49) and (51) because they both correctly put /ngu/ and /a/ in separate domains. However, (40b-c) are correctly predicted only by (51) which puts a bracket to the right of the leftmost NP, and VP, respectively. (41) is as unproblematic for (51) as it was for (49). As for (42a-b), recall that these were said to be the incorrect representation for these sentences. Consequently they fall outside the purview of (49) and (51). (43), (45), and (46a-b) are also correctly predicted by (51) whereas they were problematic for (49).

However, as pointed out earlier, (51) also gets in trouble. In particular, it is unable to account for (42c-d) and (47). In (42c) the parameter in (51) predicts a bracket to the left of the NP dominating /enen/, wrongly putting it and the preceding fous /ko/ in the same domain. In (42d) where both /mo/ and /am/ are dominated by the same maximal projection, (51) just like (49) wrongly puts the two words in the same domain. The other problematic case for (51) is in (47). In (47b) a bracket to the right of the NP that dominates /ndu rawaandu/ 'this dog' wrongly puts /rawaandu/ 'dog' and the following conjunction /e/ in separate domains whereas they should be within the same domain because VD applies in that context. These are the three cases that are problematic for (51) compared to many more problematic cases for (49). For this reason I am going to choose it to account for VD in Pulaar.

What I have been able to demonstrate so far is the fact that both the direct and indirect approach are unable to account for all the data presented in this paper in any unified way. For this reason, I propose a rule that has two components. The first component is going to ignore any c-command relation (the direct approach) or the Edge Parameter (the indirect approach). It targets heads of maximal projections and words that are not major lexical category items. It is going to account for (42c-d) as well as (47). The second component is going to account for all the remaining data. As I will demonstrate shortly, for the second component both the direct and the indirect approach are empirically equivalent. (52a-b) illustrate the two different components of the rule.

(52) Pulaar VD: a final formulation
      a.   Delete the final vowel of the final syllable of the head of a maximal projection and spread onto that syllable the initial vowel of a following word if the latter is not a major lexical category item;
      b.   XP/R

(52a) correctly predicts that in both (42c) and (42d) VD does not take place since neither first word in both cases is head of a maximal projection. In (47), however, (52a) is going to predict that since /rawaandu/ is a head (of the leftmost NP) and the word following it is not a major lexical category item, VD is going to apply. (52b) applies after (52a). An ideal situation would have been one in which reference is made just to heads of maximal projections and what follows them, as indicated in (52a). Most of the data, in fact, could be explained using that refer-

ence. However, headedness alone is insufficient. The data in (40c), for instance, are proof of that. In (40c) we have /calmin-mi/, head of the VP, which does not form a domain with the following determiner. (52a) cannot explain that. C-command or (52b) above can account for the data there. A further case that would be problematic for a solution based solely on the notion of headedness is in (45). In this example (52a) would predict /rokki/, head of the VP, to undergo VD. That is the wrong prediction. Again in this case, either (52b) or c-command correctly predicts VD to be blocked between the verb and the following object pronoun. (Since I discussed where c-command holds and where it does not I refer the reader to that discussion to better illustrate the fact that c-command, along with (52a) predicts all the data presented here in the same way (52a-b) do.)

Therefore, I conclude by saying that the rule that accounts for the data on Pulaar VD, necessarily requires the introduction of a statement like (52a), in addition to reference to either c-command or the Edge Parameter. I also come to the conclusion that the Pulaar data do not discriminate between the direct or the indirect approach to the syntax-phonology interface because either approach, along with the statement in (52a) correctly accounts for the data.

In this paper I have tried to do the following. After an introduction to the vowel system I presented a first set of data illustrating vowel deletion and vowel spreading in Pulaar. In that section the output of VD was shown to be: a long vowel, a short vowel, and a vowel-glide sequence. In (8f) I also showed that syllabification across morpheme boundaries is observed in Pulaar to the effect that the final consonant of a word and the following open-syllable word can form a syllable. Following this I introduced facts of the Pulaar syllable that are pertinent to the discussion and gave a phonological analysis of VD in the form of a two-step process: a (specific) rime merger rule that accounts for the vowel-glide sequences and a (general) nucleus merger rule for the cases where VD yields long or short vowels. These two rules, I suggested, were ordered following Kiparsky's Elsewhere Condition. After a series of derivations illustrating the rules at work I presented a new set of data (19a-b) that was apparently problematic for my general rule but I showed that these data are accounted for without changing or adding anything to the rule. The next discussion after that also shows how apparently problematic data (24) are easily accounted for without changing the rules. In (24) I demonstrated that failure of VD to apply in (24a-f) had to do with prosodic information, not the way the rule itself was formulated. In section 4 I showed that VD is sensitive to syntactic information. After presenting the data and the syntactic structures in which the two words that are supposed to be within the domain of VD appear, I introduced background information about the Pulaar noun, noun phrase, relative clause, and verbal complexes. In section 4.1 I presented the direct approach whereas the indirect approach was illustrated in 4.2. I demonstrated in these two sections that neither approach can handle all the Pulaar data in any unified way and that the correct generalization about the data required combining one of the approaches with the notion of headedness.

As I pointed out at the beginning of this paper there is a third approach to the syntax-phonology interfaced that I do not discuss here. It has to do with the issue

of what phonological rules can tell us about surface syntactic structure (Kenstowicz 1987). Another somewhat related issue that I am also not going to discuss has to do with the issue of whether phonological rules have access to deep (syntactic) structure or whether they can apply before or after the application of Move-α. The data in (45) above where VD applies after Move-α has moved the object NP raises such questions but I will leave them for further research.

NOTE

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