

Directional Asymmetries in the Morphology and Phonology of Words, with Special Reference to Bantu

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This paper is concerned with two types of word-level asymmetries and their interaction: left-right asymmetries and stem-word asymmetries. Two left-right asymmetries are examined from a wide range of languages, one morphological (the predominance of suffixation over prefixation), one phonological (the preference for anticipatory over perseverative phonology). Since phonological processes are often triggered by features which originate in roots, a second asymmetry is also addressed: the tendency for suffixes to be more tightly bound to roots than prefixes. Asymmetries between stem- vs. word phonology are examined in Bantu, where suffixes are incorporated into a derived stem domain, from which prefixes are typically excluded. This root+suffix stem domain is shown to be the locus of phonological activity in Proto-Bantu and throughout the large Bantu family, which divides into two typological zones: (i) Northwest Bantu languages, which impose a maximal size condition and stringent consonant distribution constraints on stems; (ii) Central Bantu languages, which do not restrict the size or consonant distribution of stems, but frequently impose a minimal size condition on words. The study presents a number of generalizations concerning such asymmetries and identifies questions for future research.

1. Introduction

Given the range of variation and the logical options exploited by the world's languages, one might conclude that the morphological structure and the phonological realization of words are remarkably symmetric. In terms of morphology, a root can be expanded on either side: both prefixes and suffixes are widely attested in the world's languages. In terms of phonology, either edge of a word can be the locus of special marking. In addition, internal positions for morphological or phonological marking can be calculated from either the beginning or the end of a word, e.g. for infix-placement, featural affixation, stress-assignment, and so forth. While this symmetry is non-surprising, perhaps even welcome from a formal point of view, beneath it lie a number of asymmetries that have been gradually coming to light.

The purpose of this paper is to provide an overview of two types of word-level asymmetries and their interaction: left-right asymmetries and stem-word asymmetries. While the first asymmetry will be examined via examples from different languages, the Bantu family of ca. 500 languages will be examined for addressing stem-word asymmetries.

The paper is organized as follows. In §2 I address two left-right asymmetries, one morphological, one phonological: the predominance of suffixation over prefixation and the predominance of anticipatory over perseverative phonology. §3 examines whether these asymmetries are also in effect in prosodic morphology. §4 shows how root-controlled phonology interacts (and potentially conflicts) with anticipatory phonology, while §5 addresses left-right asymmetries in stem vs. word domains, with particular reference to Bantu. §6 concludes with a brief discussion of prefix-stem fusion in light of the different findings and proposals.¹

2. Left-right asymmetries

As indicated in the preceding paragraph, the inventory of word-level phenomena is superficially symmetric. However, left-right asymmetries such as those listed in (1) have been noted in literature:

(1) Oft-noted left-right asymmetries

- a. prefixes vs. suffixes
 - i. morphology: suffixes are more prevalent than prefixes
 - ii. phonology: suffixes are more “cohering” than prefixes
- b. anticipatory vs. perseverative phonology
 - i. segmental: anticipatory phonology is more prevalent than perseverative
 - ii. tonal: perseverative phonology is more prevalent than anticipatory
- c. pre-tonic vs. post-tonic phonology
 - i. stress: post-stress syllables are weaker, more prone to reduction than pre-stress
 - ii. harmonies: post-radical syllables are more prone to harmonies than pre-radical
- d. initial vs. final edge-marking
 - i. phonology: initial strengthening/preservation vs. final weakening/loss
 - ii. morphology: stem-initiality vs. word-finality

The goal of the following subsections is to examine the above and other potential asymmetries. In §3 we will consider how these asymmetries contribute to the understanding of stem- and word-domains in phonology.

2.1. Preponderance of suffixation over prefixation

It has often been noted that suffixing is particularly prevalent across languages: “Of the three types of affixing—the use of prefixes, suffixes and infixes—suffixing is much the commonest. Indeed, it is a fair guess that suffixes do more of the formative work of language than all other methods combined.” (Sapir 1921:67) Greenberg (1966:92) notes that languages can have both prefixes and suffixes, but goes on to say that there are more languages lacking the former than the latter: “As between prefixing and suffixing, there is a general predominance of suffixing. Exclusively suffixing languages are fairly common, while exclusively prefixing languages are quite rare.” (Greenberg 1966:92)

Over the past two centuries there have been numerous attempts to relate direction of affixation with other morphological or phonological properties (see Plank 1988 for a history and appraisal of this work). More recently a number of scholars have directly addressed the question of why suffixing should be preferred over prefixing. Hawkins & Cutler (1988:285), for instance, attempt to align the direction of affixation with the head/non-head order in the syntax. They find that three out of four affix-head alignments are richly attested in the world’s languages:

(2) Three-out-of-four correlations of affix-alignment with head order

	Prefixes	Suffixes	
{VO, Pr + NP}	✓	✓	head-initial syntax co-occurs with prefixes & suffixes
{OV, NP + Po}	?	✓	head-final syntax co-occurs with suffixes

In (2) head-order is determined on the basis of where the object (O) is with respect to the verb (V) and whether the language is prepositional (Pr) or postpositional (Po). The claim is that many head-initial and head-final languages are exclusively suffixing, while head-final languages are overwhelmingly suffixing. Head-final prefixing languages are rare. To account for this “3/4 situation”, Hawkins & Cutler propose the following two principles:

(3) Suffix preference is explained by two principles

- a. Syntax: Head-Ordering Principle (HOP)
- b. Universal ranking: Suffixing >> Prefixing

First, they propose a Head-Ordering Principle (HOP): “The affix head of a word is ordered on the same side of its subcategorized modifier(s) as P is ordered relative to NP within PP, and as V is ordered relative to a direct object NP” (p.290). This gets us head-initial + prefixing and head-final + suffixing,

but not head-initial + suffixing. A lot may depend on what counts as an affix vs. something else (e.g. clitic), but their study seems to reveal both a tendency in alignment—and a gap. For the latter they claim a default preference: suffixing is universally preferred over prefixing, i.e. Suffixing >> Prefixing. In support of this they cite Hawkins & Gilligan (1988), who indicate that languages show a clear suffix tendency for marking gender, case, indefiniteness, nominalization, number, mood, tense, aspect, valence, causative. Fewer notions appear to favor prefixation, one claimed such case being person agreement (Enrique-Arias 2002).

In subsequent discussions we will see other “3/4 situations”, where three out of four logical combinations of two binary properties are attested. In each case the solution will be the same: One of the properties is specific and symmetric, the other is general and asymmetric. The latter is always available as a “default”.

2.2. Preponderance of anticipatory over perseverative phonology

While the HOP reveals a relation between head-order and direction of affixation, we still need to account for why suffixing is universally preferred over prefixing. Functional explanations have fallen in two broad categories, roughly corresponding to speaker vs. listener advantages in word packaging and word processing (Greenberg 1957, Nootboom 1981, Hawkins & Cutler 1988, Beckman 1998, Smith 2002):

(4) Explanations for Suffixing >> Prefixing

- a. informational asymmetries: root >> affix
- b. temporal asymmetries: beginnings >> ends (>> middles)

First, there are informational asymmetries between roots and affixes: Whereas affixes (grammatical morphemes) are limited in number, roots (lexical morphemes) represent an open class. Not only do roots convey more meaning in the sense that there are more to choose from, but much more of what is marked affixally is redundant or can be inferred from context. The argument, therefore, is that by placing roots before affixes, new or salient information will be conveyed earlier. This correlates with the oft-noted greater salience of beginnings of words over ends (and, in turn, over middles). In fact, aligning a root with the left edge of a word may be especially desirable for processing purposes. As Hawkins & Cutler (1988:306) put it: “We maintain that... speakers and listeners process stems before affixes.... Thus the

fact that languages exhibit a suffixing preference... [even] when their remaining structural characteristics would predict the reverse, reflects the order of computation of stem and affix in processing." On the other hand, Bybee et al (1991:35) state that their cross-linguistic survey does not provide "evidence that this alleged processing preference encourages suffixation over prefixation". They "regard the affixation process as extremely complex, involving syntactic, phonetic, semantic and processing factors" and propose a Fossilized Syntax hypothesis: "...grams develop in the position in which their lexical ancestor was located". However, if correct, the preponderance of suffixation must indicate that postposed elements are more likely to develop into grammatical affixes than preposed.

Already Greenberg (1957:89) had noted that there is an important interplay with diachrony to consider (cf. Hall 1988). First, there is the issue of origin: being disfavored, prefixes are less likely to arise. Second, there is the issue of survival: once prefixes arise, being disfavored, they are more subject to loss. Greenberg further speculates that prefixes may be particularly vulnerable due to another left-right asymmetry which is strictly phonological:

(5) Another left-right asymmetry: Anticipation >> Perseveration (lag)

- a. segmental assimilations are claimed to be more frequently anticipatory than perseverative
- b. this anticipatory tendency is said to conspire against prefixation

First, segmental assimilations are said to be more frequently anticipatory than perseverative: "In regular conditioned sound changes, the conditioning factor is far more frequently a sound which follows than one which precedes" (Greenberg 1957:90). Javkin (1979:75-76) confirms Greenberg's impression: "I examined 365 segmental assimilatory rules culled from 60 languages... documented in the Stanford Phonology Archive. 195 of these rules involved anticipatory assimilation of a segment to a following segment. 89 of these involved the perseverative assimilation of a segment to a preceding segment.... The conclusion must be that segmental assimilation is generally anticipatory...." Greenberg then conjectures that the tendency for assimilation to be anticipatory conspires against prefixes: "Once prefixes are established, the mechanism of various assimilative changes based on anticipation will result in what was originally a prefix, with a single fixed form, assuming various special alternants.... The climax of this development leads logically to an isolating form of speech in which the former prefixes have all been absorbed." (p.92) However, for this explanation to go through, it is necessary to show that suffixes are not subject to the same tendency to be "absorbed", especially as post-tonic, post-radical, and final

elements tend to reduce more than pre-tonic, pre-radical and initial elements. Bybee et al (1991:34) test this hypothesis and find that “...our data do not support the view that the affixation imbalance may be explained by reference to anticipatory assimilation or increased reduction at the ends of words.”

As an aside, it should be noted that I have characterized anticipation as a strictly segmental tendency, because tone—or at least tone spreading—has just the opposite property, as indicated in (6).

(6) Tone spreading is more perseverative than anticipatory

INPUT:	Anticipatory	Perseverative	
L-H	? $\overline{\text{LH}}$ -H	L- $\overline{\text{LH}}$	L tone spreading is perseverative
H-L	? $\overline{\text{HL}}$ -L	H- $\overline{\text{HL}}$	H tone spreading is perseverative

As Hyman & Schuh (1974:90) put it: “...tonal assimilations differ from segmental ones. The former are usually perseverative, while the latter are usually anticipatory. Thus, a rule palatalizing /k/ to [č] before [i] is more frequent than a rule palatalizing /k/ to [č] after [i]....” The perseverative nature of tone spreading is also confirmed by Javkin (1979).²

3. Prosodic morphology

In §2 we have established preferences for suffixal over prefixal morphology, and anticipatory over perseverative phonology. The question raised in the present section is whether these preferences also characterize prosodic morphology. In the following subsections I briefly consider featural affixes, infixation and reduplication.

3.1. Featural affixes

In this section we consider subsegmental or featural affixes (Akinlabi 1996, Zoll 1998). Just as full segment-size suffixes are preferred over prefixes, the same is true with non-tonal featural affixes.

Afro-Asiatic languages are well-known for their labial and palatal prosodies. Consider, for example, the following forms from Mafa, a Chadic language spoken in Cameroon:

(7) Suffixal labial and palatal prosodies in Mafa (Barreteau 1987, 1990; Ettlinger 2004)

	verb	imperfective	perfective	
a.	nda	nda-y	nda-w	‘eat’
	gudza	gudza-y	gudza-w	‘tremble’
b.	pán	pén	pón	‘wash’
	tsap	čep	tsop	‘mud’
	nakad	neked	nok ^w ad ³	‘lick’

Barreteau (1987, 1990) distinguishes two classes of verb bases: those which end in [a] vs. those which end in a consonant. As seen in (7a), the former take a segmental suffix -y in the imperfective, and a segmental suffix -w in the perfective. However, in (7b), we see that when the verb base ends in a consonant, the respective labial and palatal features are fused into the base, potentially affecting both consonants and vowels. Although we can't tell from (7b), the -w and -y in (7a) make clear that the labial and palatal prosodies are suffixal in nature.

The suffixal nature of such prosodies is also seen in the oft-cited case of Chaha, a Semitic language spoken in Ethiopia:

(8) Labial prosody in Chaha (McCarthy 1983, Rose 1993)

	verb	with 3 m.sg. obj.	
a.	qænæf	qænæf ^w	'knock down'
b.	bækær	bæk ^w ær	'lack'
c.	qætær	q ^w ætær	'kill'

In Chaha, a third person masculine singular object is expressed by labializing the last labializable (i.e. non-coronal) consonant of the verb base. Although coronal consonants will be skipped over, we see that the calculation is done on a right-to-left basis, hence that we are dealing with a suffix.

Where it is possible to tell, such morphological prosodies as in Mafa and Chaha are typically suffixal (cf. also the relation to "umlaut"). Prefixal analogues are most likely to have only local effects, resembling either metathesis or infixing. Such is the case in Noni in (9).

(9) Labial prefix in Noni, a Bantoid language spoken in Cameroon (Hyman 1981)

	pre-Noni		class 3		cf. pl. class 4
a.	*u-téŋ	>	twéŋ	'vine branch'	téŋ
b.	*u-gɛ̀ɛ̀	>	gwɛ̀ɛ̀	'ceiling'	gɛ̀ɛ̀
c.	*u-ŋgéŋsé	>	ŋgwéŋsé	'earthworm'	ŋgéŋsé

This is clearly related to the failure of prefixes to condition vowel harmony (see Hyman, in press, and references cited therein).⁴

3.2. Infixes

The possibility of viewing Noni as having featural infixation raises the more general question of how full-segment infixes fit into the asymmetries we have been discussing. Based on the appendix in Yu (2003), we see in (14) that infixation reveals a distinct left-edge bias:

(10) Left- vs. right-edge infixing (Yu 2003)

a.	# of cases of infixing calculated from left edge:	58
b.	# of cases of infixing calculated from right edge:	16
c.	# of cases of infixing which are ambiguous:	7
d.	# of cases of infixing calculated on other basis:	6

Yu was quite aware of this skewing. The following, which appeared in the text of an earlier draft of Yu (2003), considers both infixes and internal reduplication: "...cases of infixes appearing toward to the initial portion of the root are far more numerous than those appearing toward the final portion.... of the 128 cases [including internal reduplication], ninety-six of them involve initial infixation, while only twenty-eight cases can be considered final. The number of cases of initial-oriented infixation is almost three times more common than the final-oriented infixation cases. This asymmetry is not expected at all in light of the mounting psycholinguistic and typological evidence for the preference for suffixes over prefixes in the world's languages."

It may be that infixes are more likely to develop from prefixes than from suffixes. Hawkins & Cutler (1988) go only as far as stating that infixes are rare because they interrupt the stem. However, this left-bias conforms with their basic claim better than a right-bias: Speakers not only process stems before affixes, but in so doing sometimes anticipate the stem-initial, skipping over a prefix, which then gets fused into the stem. If correct, this would also correspond with an apparent anticipatory bias in speech errors (Hansson 2001).

3.3. Reduplication

Reduplication has not been surveyed for this study. However, two claims have been made in the literature concerning the position of reduplicants relative to their base. Hyman, Inkelas & Sibanda (1998) suggest that reduplicants tend to appear on the opposite side of the root from the direction of affixation: a reduplicant tends to be prefixed if the relevant domain (stem, word) is predominantly suffixing; contrarily, a reduplicant tends to be suffixed if the relevant domain is predominantly prefixing. The rationale is a morphological one: with opposite-side reduplicants, the affixes fall

outside the reduplicated base: prefixes+base+reduplicant, reduplicant+base+suffixes. Same-side reduplicants, on the other hand, can easily obscure the morphological structure.

A second claim, made by Nelson (2002), is that reduplication tends to be prefixal in general. Taken together, the two claims predict another “3/4 situation” as follows:

(11) Three-out-of-four correlations of affix-alignment with reduplicant-alignment

	RED-Base	Base-RED
Prefixing	✓	✓
Suffixing	✓	?

As seen, prefixal reduplication should be free to occur whether the domain is predominantly prefixing or suffixing, whereas suffixal reduplication should be disproportionately disfavored when the domain is predominantly suffixing. Hyman, Inkelas & Sibanda (1998) cite examples showing that Bantu stem-reduplication is prefixal (because the stem consists of a root + suffixes), whereas word-level reduplication is suffixal (since the word consists of prefixes + a stem). All of this presupposes that the reduplicant can be clearly identified, which is not always the case (Inkelas & Zoll 2005).

4. Root control

An important counter-balance to the anticipatory tendency of segmental processes is root-control (Clements 1981).⁵ As indicated in (12), both prefixes and suffixes frequently assimilate to roots:

(12) Important counter-balance to anticipatory tendency: root-control (Clements 1981)

	Anticipatory	Perseverative	
Prefix-Root	✓	?	anticipatory phonology from root to prefix
Root-Suffix	✓	✓	bidirectional phonology between suffix & root

We again have another 3/4 situation: segmental processes are bidirectional between roots and suffixes, but unidirectional between roots and prefixes. We explain this by treating root-control as the specific asymmetric constraint and anticipation as the general default. What is least expected are cases where prefixes trigger phonological changes on roots.⁶ At least the following phenomena show the combined 3/4 effects of root-control + anticipation:⁷

4.1. V+V elision and assimilation

When two vowels V_1V_2 occur in sequence either within or across a domain, there is a distinct anticipatory bias in both elision and assimilatory processes: "... V_1 elision is far more common and productive than elision of V_2 " (Casali 1997:496). On the other hand, suffixal V_2 elision may occur when preceded by a root V_1 . The asymmetry is stated as follows by Casali (1997:496): "Only V_1 elision generally occurs at the boundary between a (minimally) CV prefix and a root.... At the boundary between a root and a suffix, either V_1 or V_2 elision is possible...." What is less commonly found, therefore, is the fourth possibility: elision of a root V_2 .

4.2. C+C elision and assimilation

As in the case of vowels, C_1C_2 elision and assimilation are generally anticipatory (Ohala 1990, Steriade 2001). When there is total assimilation, the expected realization is thus C_2C_2 (Italian **otto* > *otto*), rather than C_1C_1 . Similarly, N+C sequences frequently undergo anticipatory homorganic nasal assimilation, rather than perseverative homorganic oral assimilation. This directional bias may, however, be overridden by root control (Borowsky 2000, Hyman 2001). Thus, the examples in (8) from Noni show the progressive suffix /-tè/ assimilating to a preceding velar nasal, rather than the reverse:

(13) Perseverative place assimilation of the progressive /-tè/ suffix in Noni (Hyman 2001)

INPUT:	/ciŋ-tè/	/kaŋ-tè/	'be trembling' / 'be frying'
expected:	*ci:n-tè	*ka:n-tè	anticipatory place assimilation
actual:	ci:ŋ-kè	ka:ŋ-kè	perseverative place assimilation

Again, there is a 3/4 situation: consonant assimilation is either anticipatory or involves the perseverative assimilation of a suffixal C to a root-C. What is missing is the fourth possibility: assimilation of a root-C to a prefixal C.

4.3. Consonant harmony (CH)

Numerous languages have sibilant, lateral/rhotic, nasal and other consonant harmonies. These phenomena are studied in great detail by Hansson (2001), who explicitly states that consonant harmony is either root-controlled or anticipatory. He sums up his findings as follows:

“..consonant harmony in heteromorphemic contexts seems to display only two fundamental directionality patterns. One is stem control, whereby affixes harmonize with the base to which they attach. This can give rise either to right-to-left harmony (in prefixation contexts) or to left-to-right harmony (in suffixation contexts), or a combination of both (i.e. ‘bidirectional’ harmony) in those cases where prefixes and suffixes are both within the domain in which harmony holds. The other type is fixed directionality, which is insensitive to morphological structure. In this case, harmony applies in a right-to-left fashion, i.e. as anticipatory assimilation. There are no cases of fixed directionality involving progressive (left-to-right) assimilation. Put somewhat differently, a suffix may affect the stem it attaches to, or it may be affected by that stem; a prefix, on the other hand, may be affected by the stem it attaches to, but it may *not* affect that stem. In other words, progressive harmony never goes against what the morphological structure dictates, but anticipatory harmony frequently does.” (pp. 198-9)

The missing fourth case would be where a prefixal C causes a root (stem) consonant to harmonize.

4.4. Vowel harmony (VH)

In a study on directionality in vowel harmony, Hyman (in press) claims that the same 3/4 asymmetry is at work here. VH and CH show the same 3/4 property, except: (i) root-control is more prevalent in VH than in CH; (ii) VH is more likely to target a reduced segment (vowel) than CH; (iii) CH may apply to underlyingly contrastive consonants (e.g. /s/ vs. /š/), while (root-controlled) VH is typically non-neutralizing. Concerning directionality in VH, Hansson (2001:180) is well-aware of the complexities involved: ‘If anything, progressive vowel harmony appears to be more common cross-linguistically than regressive vowel harmony, but this may well be due to the fact that suffixation is far more common than prefixation’.” (See also §4.6.)

4.5. Stress

Stress may also be subject to root-control (Alderete 2001b) as well as a directional asymmetry. Two studies have quantified primary stress placement cross-linguistically, summarized in (14).

(14) Left- vs. right-edge stress placement

	initial	peninitial	penultimate	final	left-edge	right-edge
Hyman 1977	114	12	77	97	116	174
Bybee et al 1998	11	2	9	4	13	13

While Hyman (1977) surveyed many more languages, some of the systems converge in their stress patterns due to genetic or areal factors (e.g. the number of Turkic languages included bias the results towards right-edge final stress assignment). Bybee et al's (1998) language sample is much smaller, but explicitly designed to avoid similarities which may be due to a common history. As seen, both studies show that stress placement is readily calculated from either the left- or the right edge of the relevant domain. There is, however, an asymmetry: At the left edge, cases of initial stress vastly outnumber cases of second syllable stress; at the right edge, both final and penultimate stress are attested.

As mentioned, the 1977 sample was not controlled, and it is therefore possible that final stress languages are overrepresented, i.e. that penultimate position may actually be favored over final. Although my notes are not always explicit (either my fault or due to the original source), I recalculated stress placement in those languages where I had indicated the domain (stem, word, phrase). The results are presented in (15).

(15) Stress placement by domain (based on Hyman 1977)

	initial	peninitial	penultimate	final	totals
Stem	15	0	1	4	20
Word	27	9	37	21	94
Phrase	5	0	2	2	9
totals	47	9	40	27	123

The following observations are of interest. First, in this subset of languages for which my notes indicate a domain, penultimate outnumbers final stress overall (as in Bybee et al 1998). However, there are four occurrences of stem-final stress vs. only one stem-penultimate. Although the numbers are small, it would appear that stem stress is most likely than word stress to be edge-adjacent, with a distinct preference for stem-initial. While nine cases of word-peninitial stress can be identified, stem-peninitial stress is unattested in the sample.

The above numbers do not differentiate between languages which are reported to have simple initial/final stress vs. those whose secondary stresses indicate the construction of stress feet. Hayes (1995) presents a detailed account of such systems and their variations. Stress feet can be constructed

left-to-right or right-to-left. However, Hayes (1995:265) concludes that “the evidence to decide the issue of right-to-left iambs conclusively appears to be lacking.” See also Bye & De Lacy (2000) who cite metrical evidence in favor of their Edge-Asymmetry Hypothesis: “No constraint may refer to the right edge of a constituent” (p.122).

Finally, another indication of a right-left asymmetry in stress systems is that “dominant” affixes, which have been discussed by Inkelas (1996, 1998), Alderete (2001a,b), and others, are much more likely to be suffixes than prefixes.

4.5. Dissimilation

There also is evidence that dissimilation is generally anticipatory or root-controlled, hence subject to the same 3/4 situation. This is, however, harder to show, given the wide range of dissimilatory processes that are frequently grouped together (see Suzuki 1998). One case comes from Dahl’s Law, which characterizes a number of Eastern Bantu languages (Meinhof & van Warmelo 1932). The following representative Kirundi examples are from Meeussen (1959:42):

(16) Dahl’s Law in Kirundi

a.	ku-guma	‘to stay’	b.	gu-seka	‘to laugh’
	tú-guma	‘if we stay’		dú-seka	‘if we laugh’
	tú-ta-gumá	‘without our staying’		tú-da-seká	‘without our laughing’

In (16a), where the root begins with the voiced obstruent /g/, the underlying prefixes /ku-/ , /tú-/ , and /-ta-/ are realized unchanged, hence *dú-ta-gumá. In (16b), however, where the root begins with the voiceless obstruent /s/, these prefixes undergo voicing dissimilation to gu-, dú- and -da-, respectively. Although Davy & Nurse (1982) document a number of languages where dissimilation applies iteratively, only the root-adjacent prefix -ta- ‘negative’ dissimilates in the third example in (16b), i.e. we do not obtain *dú-da-seká. The involvement of the root is seen in the last example in (16a), where the prefix -ta- ‘negative’ fails to trigger dissimilation on the consonant of the preceding prefix tú- ‘1pl’, i.e. we do not obtain *dú-ta-gumá. However, Dahl’s Law is not only root-controlled in Kirundi, as seen from the following verb forms: -bád-ik- ‘transplant’, -bád-uk- ‘grow well’ vs. -bát-ur- ‘uproot (plants) to transplant them’. Here we see that the frozen suffixes -ik- and -uk- condition voicing of the underlyingly voiceless root-final consonant /t/, which does surface in the last form. Dahl’s Law thus operates either between a root and an adjacent prefix, or is anticipatory within the stem domain.

4.6. Further discussion

The following summarizes what has been said up to this point:

- (17) a. When a process is root-controlled, either prefixes or suffixes may be affected.
 b. There is an anticipatory bias which should:
 (i) make prefixes better targets for reduction, fusion, and loss than suffixes
 (ii) make suffixes better triggers for harmony and other phonological processes.

The implication of the above is that when segments interact across identical constituent types (word-word, stem-stem, root-root, affix-affix), the effect should be anticipatory.

To test such claims, a full discussion of directional possibilities must include cases of multiple prefixation and suffixation, as in (18).

(18) [P1 - P2 - R - S1 - S2]_{word}

Using this schema, where P = prefix, R = root, and S = suffix, and based on what has been reported in the literature, Hyman (in press) judges vowel harmony possibilities as in (19).

(19) VH target/trigger + directional possibilities of forms with two prefixes and/or suffixes

	left to right	right to left		left to right	right to left
a.	local VH		d.	non-local VH (affix+root transparency)	
	P1 → P2 ?	P2 → P1 ✓		P1 → S1 ?	S1 → P1 ?
	P2 → R ?	R → P2 ✓		P1 → S2 ?	S2 → P1 ?
	R → S1 ✓	S1 → R ✓		P2 → S2 ?	S2 → P2 ?
	S1 → S2 ?	S2 → S1 ✓			
b.	non-local VH (affix transparency)		e.	root-root compound VH	
	P1 → R ?	R → P1 ✓		R1 → R2 ✓	R2 → R1 ✓
	R → S2 ✓	S2 → R ✓			
c.	non-local VH (root transparency)		f.	root-internal VH (also within P & S)	
	P2 → S1 ?	S1 → P2 ?		[V → V] _R	[V ← V] _R

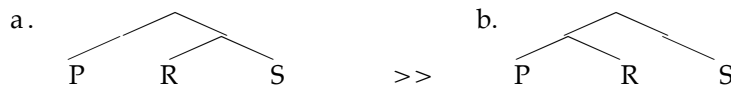
Widely attested processes are marked by (✓) and include anticipatory and root-control harmony. On the other hand, a number of recent works have noted the (near-) absence of prefix-controlled vowel harmony, marked by (?). However, the (?) on P1 → P2 indicates that we need to ask whether this is because of a condition on prefixes as triggers, roots as targets, or both. Specifically, can a prefix initiate vowel harmony onto prefixes to its right or left? If the parameters are root-control and anticipatory assimilation, then the checks vs. question marks in (19a) indicate the following: (i) P2 can harmonize

P1, but P1 cannot harmonize P2 (or R); (ii) S2 can harmonize S1, and S1 can harmonize R, but S1 cannot harmonize S2.⁸ All of these claims need to be tested against another dichotomy, stem vs. word, discussed in the next section.

5. Stem and word domains

The preceding sections have established that there is reason to believe in the left-right asymmetries concerning prefixing vs. suffixing and anticipatory vs. perservative phonology. However, there is a complicating factor that needs to be brought into the equation: Suffixes tend to be more tightly bound to their root than prefixes. What this means is that more languages have the structure in (20a) than in (20b).

(20) Suffixes tend to be more tightly bound to their root than prefixes



In support of this observation one might cite the proposals one finds in the literature that some or all prefixes are phonological words, e.g. in Germanic, whereas suffixes are not (Booij & Rubach 1984, Nespor & Vogel 1986, Wennerstrom 1993, Raffelsiefen 1999 etc.). This in turn is related to the finding of Bybee, Pagliucca & Perkins (1991:16) that even beyond affixes, preposed grammaticized elements tend in to be less bound than postposed. Languages do exist which have either multiple prefixation + one suffix slot or multiple suffixation + one prefix slot, suggesting both structures in (20). However, those which have both multiple prefixation and multiple suffixation appear almost always to have the structure in (20a).⁹ The structure in (20a) is also consistent with the observation that suffixes are more prone to reduction than prefixes, just as post-tonic elements are more prone to reduction than pre-tonic elements (cf. Barnes 2002 and references cited therein). This, however, leads to the conclusion that some forces conspire against prefixes and others against suffixes. Recall Greenberg's (1957) distinction between "origin" and "survival" in §2.2. Whereas Greenberg hypothesized that prefixes are vulnerable targets of anticipatory assimilation—and hence less likely to survive, Bybee, Pagliucca & Perkins (1991) hypothesize that prefixes are less likely to develop in the first place.¹⁰ Although Greenberg hypothesized that suffixes are more secure, we see them as more tightly bound, subject to reduction and ultimate assimilation or loss. How can these contradictory views be reconciled?

It should be evident from the above that many of the expressed views, including my own, are impressionistic, based on our personal experience or intuitions. An exception is Bybee, Pagliucca & Perkins (1991), who test various claims concerning asymmetries in affixation against a sample of 71 languages which have been carefully selected to minimize genetic or areal convergences. Significantly, the languages were not chosen because they were felt to provide the best inputs for studying the nature of prefixing vs. suffixing. An alternative approach would be to look in some depth at languages which are specifically selected for their rich affixation systems. Two strategies might be followed: (i) compare languages with multiple prefixation vs. languages with multiple suffixation; (ii) look at languages with multiple prefixation *and* multiple suffixation. This latter strategy is adopted in the following subsections which examine stem vs. word properties in the Bantu group of ca. 500 languages. The properties of stem- and word domains are treated, respectively, in §5.1 and §5.2.

5.1. The stem domain

Although Sapir (1921:126) characterizes Bantu as “prevalingly prefixing”, data such as in (21) demonstrate that suffixes abound:

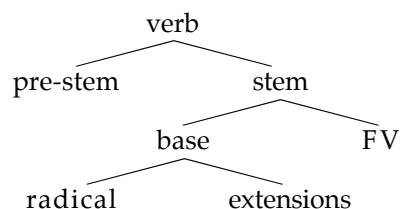
(21) Derivational suffixes (“extensions”) in the Ciyao verb stem (Ngunga 2000)

a.	taam-	‘sit’		
b.	taam-ik-	‘seat’ (put in seated position)	-ik-	(impositive)
c.	taam-uk-ul-	‘unseat’	-ul-	(reversive tr.)
d.	taam-uk-ul-igw-	‘be unseated’	-igw-	(passive)
e.	taam-uk-ul-igw-aasy-	‘cause to be unseated’	-aasy-	(causative)
f.	taam-uk-ul-igw-aasy-an-	‘cause each other to be unseated’	-an-	(reciprocal)
g.	taam-uk-ul-igw-aasy-an-il-	‘cause e.o. to be unseated for/at’	-il-	(applicative)

The above verbs are derived verb bases which require other morphemes to form acceptable stems and words.¹¹ We shall now see that the Bantu stem is built via suffixation, while the word is built via prefixation.

Ignoring clitics, the Proto-Bantu word structure of verbs is shown in (22).

(22) Proto-Bantu word structure of verbs (Meeussen 1967)



In (23), the different subconstituents and their canonical and non-canonical shapes are identified:

(23) Identification of subconstituents and their canonical and non-canonical shapes

			canonical	non-canonical
a.	pre-stem	subj, neg, tense, asp, obj prefixes	CV-	V-, N-, (C)VV-?
b.	radical	verb root	≠CV(N)C-	≠CV, ≠CVVC-, ≠VC-
c.	extensions	expansions/ derivational suffixes	-VC-	-V-, -VNC-, -C-
d.	FV	inflectional final suffix	-V	-VV, (-VC-V)

There are two constituents of particular interest: The verb stem consists of a verb base (root plus derivational suffixes) and an obligatory inflectional final vowel (FV) morpheme, most commonly -a. The verb (word) consists of a stem plus inflectional prefixes (pre-stem). The column of canonical shapes show the following:

- (i) prefixes are canonically C-initial, while suffixes are canonically V-initial
- (ii) prefixes are canonically V-final, while (non-final) suffixes are canonically C-final
- (iii) roots are canonically -CV(N)C-, i.e. C-initial and C-final

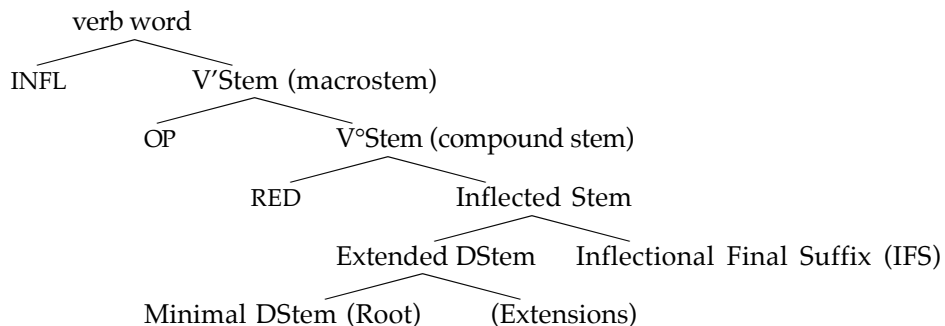
If the canonical shapes are concatenated, we obtain the following schema of the canonical full verb: (CV)*-CV(N)C-(VC)*-V. Although non-canonical morpheme shapes do exist, concatenation of canonical morpheme shapes produces CV syllables. Depending on the language, the availability of multiple prefixes and suffixes can produce quite elaborate words, such as the one from Kinande in (24).

(24) Elaborate Kinande example (Ngessimo Mutaka, cited in Nurse & Philippson 2003b:9)

tu-né-mu-ndi-syá-tá-sya-ya-ba ≠king-ul-ir-an-is-i-á =ki-ô (≠ stem; = clitic)
 'we will make it possible one more time for them to open it for each other'

While (22) represents the traditional Bantuist view of Bantu verb structure, there have been several elaborations to this scheme, such as the one in (25).

(25) Elaboration of Bantu verb structure (Downing 1999:75)



The question is how (23) or (25) translate into prosodic domains. Some of the possibilities are seen in (26).

(26) Analysis into domains (GW = grammatical word; PW = phonological word)

- a. Traditional b. Myers (1995, 1998) c. Among other possibilities
- GW

└─ Stem_φ

PW

├─ INFL_{stem} Verb_{stem}

GW,PW

└─ Stem_φ

As seen, all analyses give special status to the stem, discussed in this subsection, and the word, discussed in §5.2. What is important for the present purposes is to recognize that Meeussen's Proto-Bantu stem is the unambiguous locus of much of phonological or prosodic activity in Bantu, as summarized in (27).

(27) Meeussen's Proto-Bantu stem is an unambiguous locus of prosodic activity in Bantu

- a. vowels: distribution, vowel harmony
- b. consonants: nasal consonant harmony
- c. tones: distribution, Meeussen's reconstruction of extension tones
- d. reduplication: verb reduplication is usually limited to the stem

In the remainder of this section, each of these stem properties will be examined in turn.

The distribution of vowels by position in Proto-Bantu is shown in (28).

(28) PB vowel reconstructions by position (4-7-4-7)

prefix V	≠	first stem V	+	extension Vs	+	final stem V
<div style="border: 1px solid black; padding: 5px; display: inline-block;"> <i>*i</i> <i>*ɪ</i> <i>*u</i> <i>*a</i> </div>		<div style="border: 1px solid black; padding: 5px; display: inline-block;"> <i>*i</i> <i>*u</i> <i>*ɪ</i> <i>*u</i> <i>*ɛ</i> <i>*ɔ</i> <i>*a</i> </div>		<div style="border: 1px solid black; padding: 5px; display: inline-block;"> <i>*i</i> <i>*ɪ</i> <i>*u</i> <i>*a</i> </div>		<div style="border: 1px solid black; padding: 5px; display: inline-block;"> <i>*i</i> <i>*u</i> <i>*ɪ</i> <i>*u</i> <i>*ɛ</i> <i>*ɔ</i> <i>*a</i> </div>

As seen, Proto-Bantu had a seven-vowel system, the full set of which we find in the first and last position of the stem. Prefix and extension vowels, however, were limited to four, with **i* being rarer than the other three. What distinguishes prefixal from post-radical extension vowels, however, is the vowel height harmony to which the latter are subjected:

(29) "Asymmetric" vowel height harmony (Hyman 1999)

- a. front : **ɪ* > *ɛ* / { *ɛ*, *ɔ* } C ____
- b. back : **u* > *ɔ* / { *ɔ* } C ____

As seen, the degree two vowel **ɪ* becomes [ɛ] after the two mid vowels **ɛ* and **ɔ*, while **u* becomes [ɔ] only after **ɔ*. Hyman (1999) documents which languages have such "asymmetric" height harmony as

well as other variations, including certain languages which have extended the process to prefixes. Note that the FV is typically not targeted by vowel height harmony.

While vowel distribution is affected by the position within the stem and word, (30) shows a different situation with respect to Proto-Bantu consonant distribution:

(30) Distribution of consonants by position

	*p	*t	*c	*k	*b	*d	*j	*g	*m	*n	*ɲ	*mb	*nd	*nj	*ŋg	totals
pref	2	5		9	5	2	4	3	8						1	39
C ₁	222	281	181	300	205	253	207	172	43	35	11				3	1913
C ₂	71	116	40	180	93	360	50	80	126	100	12	173	119	31	213	1764
C ₃	1	22	4	54	10	124	1	5	34	15	1				9	280
suff	1	2	1	3	1	5			1	1					1	16

The numbers in (30) are based on 1939 lexical records in Meeussen (1969) plus the grammatical morphemes reconstructed by Meeussen (1967). The C₁, C₂ and C₃ designate positions in roots with up to three consonants, i.e. C₁VC₂CV₃. As indicated by the shaded cells, the major restriction that stands out concerns nasal clusters, which, except for *ŋg, occur exclusively in C₂ position (cf. Teil-Dautrey 2004).¹² Although most analyses of present-day Bantu languages propose that the syllable break appears before a nasal cluster, Downing (2005) argues that the preconsonantal nasal is syllabified as a coda. If correct, this would allow us to hypothesize that nasal clusters were restricted to C₂ position because only the initial stem syllable could have a coda in Proto-Bantu (cf. Basaa in (38a)).

Although not a property of Proto-Bantu, there is a common nasal harmony process that affects only post-radical voiced stem consonants. Yaka examples are seen in (31).

(31) Innovative (long-distance) nasal consonant harmony in Yaka (Hyman 1995)

a.	kík-idi	'block+perf'	b.	kún-ini	'plant+perf'
	kúd-idi	'chase+perf'		mák-ini	'climb+perf'
	kás-idi	'tie+perf'		mítuk-ini	'pout+perf'

Prefixes never trigger (or undergo) the perseverative nasal harmony process, which also will never target C₁ consonants. Thus, even innovative processes show a sensitivity to the stem domain in the daughter languages.

Besides vowel and consonant properties, the stem is an important locus of tonal phonology. As seen in (32), two tones are reconstructed in Proto-Bantu:¹³

(32) Tonal distributions in the Proto-Bantu word

prefix Vs	\neq	first stem V	+	extension Vs	+	final V
*H, *L		*H, *L				*H, *L

As in the case of vowels, it is the post-radical extension vowels which fail to provide the full contrast.

As shown in (33), Meeussen (1961, 1967) proposes a rule of anticipatory tonal assimilation of *H or *L of FV onto extension vowels in Proto-Bantu:

(33) Anticipatory tonal assimilation from the final onto extension vowels (Meeussen 1961, 1967)



Whereas the above tonal assimilation is anticipatory, we saw in (29) that vowel harmony is perseverative (root-controlled). Some Bantu languages in the Western and Northwestern part of the zone have innovated anticipatory vowel harmony as well. Thus, (34) summarizes the realization of post-radical vowel combinations in Punu:

(34) Innovative anticipatory vowel harmony of post-radical vowels in Punu (Fontaney 1980)

CVC +	i	u	a	
iC	iC-i	<u>u</u> C-u	iC-ə	i → u / __ Cu
uC	uC-i	uC-u	uC-ə	
aC	<u>i</u> C-i	<u>u</u> C-u	əC-ə	a → i / __ Ci a → u / __ Cu

As seen, both suffixal /i/ and /a/ assimilate to a following /u/, while suffixal /a/ also assimilates to a following /i/. Vowel harmony never affects the root vowel or prefixes. In addition, non-assimilated suffixal /a/'s are realized [ə], while both root and prefixal /a/'s are realized [a]. Like the tonal process in (33), the inescapable conclusion here is that suffix vowels assimilate in a right-to-left fashion.

Recall that the four reconstructed extension vowels in (28) occur between a full set of seven vowels in Proto-Bantu and many daughter languages. The toneless extensions are also surrounded by the root and FV, both of which display a *H vs. *L tonal contrast. To account for the limited distinctiveness and weakness of the extensions, which are targeted both by vowel harmony and tone spreading, Hyman (1998) proposes that the extension domain constitutes a “prosodic trough” τ . This corresponds to the observation in (4b) above, whereby initials are most prominent, followed by finals, followed by middles.

In much of what I shall refer to as Central Bantu (CB), derived verb stems can be quite long (cf. Ciyao in (21)). In contrast, Punu and many Northwest Bantu (NWB) languages are subject to stem-maximality conditions. As summarized in (35),

(35) Four-syllable maximum stem in Punu (Blanchon 1995)

a. Attested	b. Not attested	[total = 1724 verbs]
CVC-iCiC-V : 24	*CVC-iCuC-V	
CVC-uCuC-V : 61	*CVC-iCaC-V	
CVC-aCaC-V : 69	(CVC-uCaC-V) : 4	
CVC-uCiC-V : 16	*CVC-aCuC-V	
	(CVC-aCiC-V) : 2	

stems in Punu are maximally quadrisyllabic with severe constraints on vowel (and consonant) distributions within the prosodic trough (cf. (34)). A similar situation is found also in Yaka (Hyman 1998, based on Ruttenberg 1971 [2000]).

Other NWB languages limit the stem to a maximum of three syllables, e.g. Koyo:

(36) Three-syllable maximum stem in Koyo

a.	kór-a	'to tie'	bar-a	'to bite'
	kór-is-a	'to cause to tie'	bar-is-a	'to cause to bite'
	kór-in-a	'to tie each other'	bar-in-a	'to bite each other'
	*kór-is-in-a, *kór-in-is-a		*bar-is-in-a, *bar-in-is-a	
b.	dzáa	'to eat' /dzé-a/	tá-a	'to see'
	dzé-s-a	'to cause to eat, feed'	tá-s-a	'to cause to see, show'
	dzé-n-a	'to eat each other'	tá-n-a	'to see each other'
	dzé-s-en-a	'to feed each other'	tá-s-an-a	'to show each other'
c.	yigin-a	'to get accustomed to' (*yig-)	súndzin-a	'to decrease, shorten' (*súndz-)
	yig-is-a	'to cause to be accustomed'	súndz-is-a	'to cause to decrease'

As seen in (36a), the verbs kór- 'tie' and bar- 'bite' can take either a causative -is- or reciprocal -in- extension. What they cannot do is combine the two in either order, because forms such as *kór-is-in-a or *kór-in-is-a would surpass the trisyllabic limit on stems. We see in (36b) that CV verbs such as dzé- 'eat' and tá- 'see' can combine the two extensions, since there is room in the trisyllabic template. Finally, (36c) shows that some verbs have replacive causative suffixation: the frozen expansion [in] is replaced by -is-. What this means is that suffixation is possible only if there is room in the maximally trisyllabic stem.¹⁴

There actually are two differences between Koyo and CB. First, unlike Ciyao in (21), there is a limit to how many suffixes can be added within the stem. Second, unlike the situation in Proto-Bantu

(30), there are severe restrictions on which underlying consonants can appear in which stem positions, as well as on their realization. The properties of the Koyo prosodic stem are summarized in (37).

(37) Properties of the prosodic stem in Koyo

- a. stem structures: CV, CV.V, CV.CV, CV.CV.CV
- b.
- | | | | | | | | | | | | | | | | | | | |
|------------------|---|---|---|---|----|---|---|---|---|----|----|----|---|---|-----|---|---|----|
| C ₁ : | p | b | w | m | mb | t | l | s | n | nd | ts | dz | y | ɲ | ndz | k | h | ŋg |
| C ₂ : | | b | | m | mb | r | l | s | n | nd | | | y | ɲ | ndz | | g | |
| C ₃ : | | | | m | | r | l | s | n | | | | | | | | g | |

The acceptable stem structures are given in (37a). These allow for up to three consonants (C₁, C₂, C₃). As seen in (37b), the full set of consonants appears in C₁ position, while only a subset occur as C₂, even fewer as C₃. In addition, C₂ and C₃ /t/ and /k/ are realized as [r] and [g]: /i-tɔtɔ/ → i-tɔrɔ ‘banana’, /o-tokiti/ → o-togiri ‘sweat’, etc. Since /p/ cannot occur in these positions, what this means is that /s/ is the only [-voice] consonant to appear non-stem-initially.

The consonant distribution and realizations in (37) point to an important edge-asymmetry in the stem phonology of NWB languages. There is a marked decrease in the number of consonantal oppositions as one goes from left to right within the stem. In addition, consonants occurring later are subject to weaker realizations. Stem-initial resistance to weakening is particularly striking in Basaa, whose stem properties are summarized in (38).

(38) Maximum of three syllable stem in Basaa

- a. stem structures: CV, CVC, CV.CV, CV.CVC, CVC.CV, CVC.CVC, CVC.CV.CV
- b.
- | | | | | | | | | | | | | | | | | | | | | | | |
|------------------|---|---|---|---|----------------|-------|---|---|---|---|----------------|---|---|---|---|---|---|----------------|----|----|----|----|
| C ₁ : | p | t | c | k | k ^w | s | h | ʃ | l | j | g ^w | y | w | m | n | ɲ | ŋ | ŋ ^w | mb | nd | ɲj | ŋg |
| C ₂ : | b | d | | g | | s ~ h | | | l | | | y | | m | n | | ŋ | | mb | nd | | ŋg |
| C ₃ : | b | d | | g | | s ~ h | | | l | | | | | | | | | n | | | | |
| C ₄ : | | | | | g | | h | | | | | | | | | | | n | | | | |

As in Koyo, Basaa stems are limited to three syllables (see Hyman 2003b & references cited therein). The full set of consonants is found in C₁ position, with progressively fewer in C₂, C₃ and C₄ positions. The most striking property concerns the distribution of non-contrastive voicing on stops: There is a single series of stops /P, T, K/ which is realized [p, t, k] stem-initially, but as voiced (and often continuant) in all other positions.¹⁵ Illustrations are provided in (39).

(39) Realizations of the single stop series /P, T, K/

Underlying	Orthographic	Phonetic	
/T í TK í/	tídgí	tírgí	‘small’
/KǝKnà/	kǝgnà	kǝynà	‘crush each other’
/li-màPKà/	limàbgà	li-màβgà	‘taking form’ (class 5)
/Pi-Pà/	bìpà	bì-pà	‘machete’ (class 8)
/Tì-KǝTá/	dìkǝdá	dì-kǝrá	‘pipes’ (class 13)

The voiced realizations are found not only in C₂, C₃ and C₄ stem positions, but also in prefixes, e.g. class 8 /Pi-/ is realized bi- (~ [βi-]), and class 13 /Tì-/ and first person plural /Tì-/ are both realized dì- (~ [rì-]). As seen in (40), the continuant allophones can be conditioned by a preceding stem:

(40) Postvocalic spirantization of a prefix consonant can be conditioned by the preceding stem

- a. /sáá Pi-Pà/ → sáá bì-pà [sáá βí-pà] ‘scatter machetes’
 b. /sáá Tì-KǝTá/ → sáá dì-kǝdá [sáá rí-kǝrá] ‘scatter pipes’

When class 13 /Tì-/ fuses with a vowel-initial root, thereby becoming stem-initial, the result is voiceless: /Tì-áy/ → [tʃǎy] ‘leaves’ (cf. /Tì-nùní/ → dì-nùní ‘birds’).¹⁶

The importance of Basaa is that the voiceless (=strong) stop realizations are conditioned specifically by stem-initial, not word-initial position. In other cases it is hard to tell, since many of the languages which place initial strength conditions on consonants do not have prefixes (cf. the discussions in Beckman 1998 and Smith 2002). If the voicing of stops were dependent on word initiality, we would expect prefixes to alternate as well: /Pi-/ and /Tì-/ would be realized [pì-] and [tì] if word-initial, but as [bì- ~ βì-] and [dì- ~ rì-] when preceded by another prefix. Since no such case has been reported, I assume that such processes specifically target the left edge of *stems* (cf. Smith’s MWord) and propose the following asymmetry in (41).

(41) Strength asymmetry

- a. **Strong** vs. b. **Weak**
 stem-initial word-final

As indicated, from the point of view of their edges, stems and words don’t work the same way. While this can be partially attributed to the function of demarcating the beginning of lexical morphemes, this tendency is partly undermined by cases where a prefix fuses onto a vowel-initial root, as in Basaa /Tì-áy/ → [tʃǎy] ‘leaves’.

Paulian (1975) has interpreted similar facts as evidence of a stem-initial accent in Kukuya, another NWB language. The prosodic stem in Kukuya has the properties in (42).

(42) Properties of the prosodic stem in Kukuya (Paulian 1975; cf. Hyman 1987)

- a. Five syllable shapes: CV, CV.V, CV.CV, CVV.CV, CV.CV.CV
- b. Five tonal “melodies”: L, H, LH, HL, LHL
- c. Six C₂ or C₃ possibilities: P, T, K, l, m, n
- d. Six C₂-C₃ combinations: C-n-m, C-T-K, C-l-K, C-l-P, C-K-P, C-T-P
- e. Prefix consonants: P, K, l, m

As seen in (42a), stems may have from one to three syllables and be mono-, bi- or trimoraic. Independent of their length, Paulian identifies exactly the five “schèmes tonals” (tonal melodies) in (42b). While the language contrasts a large number of stem-initial consonants (some with complex secondary articulations), only the six in (42c) occur in C₂ or C₃ positions: Among these are the underspecified consonants /P/, /T/, and /K/, which are realized, respectively, as [b ~ β], [r], and [k ~ g ~ ɣ]. Since six consonants are possible, we expect 36 (i.e. 6 x 6) possible combinations of C₂ + C₃. However, as indicated in (58d), there are only six combinations. Missing are cases where the C₂ and C₃ consonants are produced at the same place of articulation or where they disagree in nasality. In addition, the attested sequences must be either coronal C₂ + non-coronal C₃ or velar C₂ + labial C₃. Finally, as indicated in (42e), prefix consonants are restricted to only four: /P, K, l, m/.

As presented, the Kukuya facts are an elaboration of what has been seen in Koyo and Basaa.¹⁷

Even more important are three additional properties pointed out by Paulian (1975):

- (i) there is a “pause”, however slight, before every C₁ consonant
- (ii) a C₁ nasal or /l/ is automatically geminated (/Pù≠nónó/ → [bù.nnó.nó] ‘selfishness’)
- (iii) prefixes join the *preceding* stem to form a clitic-group-like P-domain

Paulian takes all of the above properties—especially (i) and (ii)—to be indications of a stem-initial accent in Kukuya. The most striking fact is perhaps that in (iii): Prefixes which do not fuse with a vowel-initial root instead join a preceding stem to form a clitic-group-like prosodic domain (Hyman 1987). One possible interpretation is “ex-prefixation”: prefixes break off and join a preceding stem to form a domain. Another is that these noun class markers, inflectional markeres on verbs etc. are not prefixes at all, rather proclitics. Either way the generalization is that P-domains are stem-initial in Kukuya. Adopting proposals of Chen (1987) and Selkirk (1986), an end-based algorithm of the sort

“mark off the beginning of every stem” would work quite well in Kukuya, leaving only an utterance-initial prefix/proclitic as extraprosodic. The important issue is that there is no phonological interaction between what otherwise appear to be prefixes and their respective stems.

Before moving on to consider word domains, for completeness, let us briefly mention the rather well-known phenomenon of verb stem reduplication in Bantu. In both NWB and CB verb reduplication typically excludes prefixes. The exceptions concern cases where the inclusion of one prefix either provides a needed second syllable (in case the stem is monosyllabic), or provides an onset to the reduplicant (see Downing 1999 and references cited therein). Other Bantu languages consistently exclude prefixal material in all cases.

To summarize, the Bantu verb stem is clearly the locus of considerable phonological activity subject to clear left-right asymmetries. Since prefixes are excluded, one interpretation has been that stem-level processes constitute the “stratum 1” phonology of lexical phonology (Kiparsky 1982, 2000).¹⁸ Stratum 2 or post-lexical word domains, which include prefixes if not also clitics, are the subject of the next section.

5.2. Word domains

In the preceding section we saw that the stem functions as a prosodic domain in most, if not all Bantu languages. Let us refer to this as the P-stem, whose left edge is normally marked by the root. We have been able to define the P-stem because several criteria converge (C/V distributions, vowel harmony, consonant harmony, tone, etc.). In this section we address a more difficult issue, that of defining the word domain (or domains) in Bantu. As we shall see, the traditional Bantuist definition of the word (prefixes + stem) works in some cases, but not others.

I begin by providing in (43) a list of arguments that would together confirm the validity of the phonological word (PW) as a distinct domain from the grammatical word (GW) (cf. Selkirk 1980, 1984; Nespor & Vogel 1986, etc.):

(43) Potential arguments distinguishing PW from GW

- a. multiple reference to the same PW
- b. different types of reference (e.g. left-/right-edge of PW, throughout the PW etc.)
- c. higher (PhP) and lower (foot) reference to the same PW within a prosodic hierarchy
- d. no contradictory reference (e.g. a part of one PW cannot belong to another PW)

- e. cross-linguistic comparability (i.e. PW is well-defined across languages)

It is often said that the PW is non-isomorphic with the GW. Linguists have described at least three situations where $PW \neq GW$ (cf. Booij 1983, Nespor & Vogel 1986):

(44) Three situations where $PW \neq GW$

- a. $PW < GW$: PW is foot-like
- b. $PW > GW$: PW is CG-like
- c. $PW \Leftrightarrow GW$: PW is compound-like

The first situation (44a) is where the PW is smaller than the GW, i.e. it is foot-like. Those analyses which propose that prefixes are PWs in Germanic, or where maximally bisyllabic reduplicants are PWs in Bantu are examples. The second situation (44b) is where the PW is larger than the GW. In this case the PW consists of the GW augmented by proclitics and/or enclitics, thus resembling the clitic group (CG) domain (Nespor & Vogel 1986). This notion of PW has been proposed for certain Bantu languages, e.g. Shona: “A phonological word... consists of a full word with a maximal string of functional words cliticized onto one end. Phonological words in different languages differ in just two parameters: the membership of the set of functional categories, and the direction of cliticization” (Myers 1995:85). Finally, (44c) is intended to describe compounds where prefixes form a domain with the first stem and suffixes a domain with the second stem: $\text{prefix} \widehat{\text{stem}}_1 \neq \text{stem}_2 \widehat{\text{suffix}}$.

It is not clear whether the above characterizations are contradictory or complementary. It may in fact be necessary to distinguish different kinds of PW, which may or may not coincide in a given language. Some of the possibilities are listed in (45).

(45) Different kinds of PW?

- | | |
|-------------------------------|--|
| a. the demarcative word | a property marks the beginning or end of the word |
| b. the culminative word | a feature occurs only once per word |
| c. the harmonic word | a feature is realized throughout the word |
| d. the metrical word | a word consists of hierarchically arrayed moras or syllables |
| e. the minimal word | a word must consist of a minimum # of moras or syllables |
| f. the maximal word | a word can consist of a maximum # of moras or syllables |
| g. the phonotactic word | a word permits only certain output segments/sequences |
| h. the morphophonotactic word | a word permits only certain input segments/sequences |

Even within the above categories, we must confirm that different phonological features define the same PW (VH, tone, nasalization, etc.). Within Bantu this is easier to do with respect to the P-stem than the PW.

To anticipate the following discussion, three major points can be made concerning “small and large” word-like P-domains in Bantu:

- (i) Bantu languages seem alike but mask a lot of differences
- (ii) When a language has enough going on in its P-domains, there can be “mismatches”, syntactic conditions, and “look ahead” phenomena (e.g. Hayes 1987).
- (iii) Much of Northwest Bantu is quite different from the rest of Bantu.

Consider, first, the relevance of Meeussen’s Rule (MR) in establishing PWs. This is a rule of high tone dissimilation by which a /H + H/ input is realized H-L (or H-Ø). Myers (1998) analyzes MR as applying only across a macrostem or clitic boundary in Shona:¹⁹

(46) Meeussen’s Rule said to apply only across a macrostem or clitic boundary in Shona

- | | | | | | |
|----|------------------------|---|---------------|-----------------|--|
| a. | [ndi-cha-] [tenga] | → | ndi-chá-tenga | ‘I will buy’ | (cf. ku-téngá ‘to buy’) |
| | \ | | | | |
| | H H | | H | | |
| b. | [va-cha-] [tenga] | → | vá-chá-tenga | ‘they will buy’ | |
| | \ | | | | |
| | H H H | | H H | | |
| c. | [ku] [ri - tenga] | → | ku-rí-téngá | ‘to buy it’ | (the class 5 object marker ri- belongs to the “macrostem”) |
| | \ | | \ | | |
| | H H | | H H | | |
| d. | [ne] [banga] | → | né banga | ‘with a knife’ | (cf. bángá ‘knife’) |
| | \ | | | | (proclitic + noun) |
| | H H | | H | | |
| e. | [mwana] [i] | → | mwaná i | ‘which child’ | (cf. munhu í ‘which person’) |
| | | | | | |
| | H H | | H | | |

Myers’ view is that Shona provides evidence for the representation of the PW in (26b): MR would in this case apply only when the two H tones meet across a GW bracket.

Quite distinct from the Shona situation, MR applies throughout the prefix+stem word in Luganda (47a), but does not affect clitics (47b,c):

(47) Meeussen’s Rule applies throughout the prefix+stem word in Luganda, but not across clitics

- | | | |
|----|---|----------------------------|
| a. | [a-ba- ta-li- [tu- [lab-a] _{STEM}] _{MS}] _W | a-bá-tà-lì-tù-làb-a |
| | | IV-3pl-neg-fut-us-see-FV |
| | H H H H H | ‘they who will not see us’ |
| | ↓ ↓ ↓ ↓ | |
| | L L L L | |
| b. | [né= [kí-gùùndù] _{PW}] _{CG} | |
| | | |
| | H H | |
| | ‘with Kiguundu’ | |
| c. | [[a-sib-á] _W =kô] _{CG} | |
| | | |
| | H H | |
| | ‘he who ties a little’ | |

In this case we need to refer to the traditional Bantu word (prefixes + stem), which is supported by at least one other tonal fact. As seen in (48a), prefix+stem words can have one drop from H to L (´ `), or they can be lexically toneless (48b):

(48) Prefix+stem words can have one drop from H to L, or they can be lexically toneless

a.	ki-bê	‘jackal’	ki-sásilo	‘rubbish’	ki-jîko	‘spoon’
	ki-kópò	‘cup’	ki-yulífù	‘torn’ (cl.7)	ki-bíínâ	‘society’
	ki-sikî	‘log’	ki-wójjólò	‘butterfly’	ki-wúúgúlû	‘owl’
	ki-lókwâ	‘weed’	ki-bónèlezo	‘punishment’	ki-sàànikizo	‘cover, lid’
	kí-kòlwa	‘deed’	ki-begábèga	‘shoulder’	ki-sáákáátè	‘reed fence’
b.	ki-de	‘bell’	ki-tabo	‘book’	ki-tooke	‘plantain tree’
	ki-bya	‘bowl’	ki-muli	‘flower’	ki-seenge	‘room’
	ki-lagi-ro	‘command’	ki-biiliti	‘match(-box)’	ki-sanilizo	‘comb’
	ki-papajjo	‘branch’	ki-janjaalo	‘bean’	ki-sumuluzo	‘key’

The latter words receive their output tones at the phrase level. In the following examples, the phrasal boundary tones %L...H% map as LHⁿ (Hyman & Katamba, in press):

(49) Phrasal %L...H% boundary tones map as LH*

a.	kì-dé	‘bell’	kì-tábó	‘book’	kì-tóóké	‘plantain tree’
	kì-byá	‘bowl’	kì-múlí	‘flower’	kì-sééngé	‘room’
b.	kì-lágíró	‘command’	kì-bíílítí	‘match(-box)’	kì-sánílízó	‘comb’
	kì-pápájjó	‘branch’	kì-jánjááló	‘bean’	kì-súmúlúzó	‘key’
c.	%L H%		%L H%		%L H%	
	/ \		/ \		/ \	
	kì- pápájjó		kì- jánjááló		kì- súmúlúzó	

As seen in (49c), the %L boundary tone links to the first vowel, and the final H% boundary tone to the remaining toneless vowels.

By this criterion, the initial vowel augment (or preprefix) seen on the following nouns is a prefix:

(50) The initial vowel augment (preprefix) is a prefix

a.	è-kí-dé	‘bell’	è-kí-tábó	‘book’	è-kí-tóóké	‘plantain tree’
	è-kí-byá	‘bowl’	è-kí-múlí	‘flower’	è-kí-sééngé	‘room’
b.	è-kí-lágíró	‘command’	è-kí-bíílítí	‘match(-box)’	è-kí-sánílízó	‘comb’
	è-kí-pápájjó	‘branch’	è-kí-jánjááló	‘bean’	è-kí-súmúlúzó	‘key’

Just as the /H/ of the proclitic /né=/ did not trigger Meeussen’s Rule in (47b), the mapping of boundary tones in (51) allows us to establish a criterion for distinguishing toneless proclitics from prefixes:

(51) Proclitics are by this criterion not in the same PW

- a. class 2a ba=
 bà= kàtón dá 'gods' bà= Mùkásá 'the Mukasas'
- b. locatives ku= (class 17) and mu= (class 18)
 kù= kì-dé 'on the bell' mù= kì-dé 'in the bell'
 kù= kì-tábó 'on the book' mù= kì-tábó 'in the book'
 kù= kì-sánízí zó 'on the comb' mù= kì-sánízí zó 'in the comb'
- c. na= 'with, and' (comitative, instrumental, associative)
 nà= kì-dé 'with a bell' nà= Kàtón dá 'with God'
 nà= kì-tábó 'with a book' nà= Mùkásá 'with Mukasa'
 nà= kì-sánízí zó 'with a comb'
- d. genitive linker -aa=; here: /bi-aa/ 'those of' (class 8)
 byàà= mù-ntú 'those of a person' byàà= Kàtón dá 'those of God'
 byàà= mù-límí 'those of a farmer' byàà= Mùkásá 'those of Mukasa'
 byàà= mù-lámú zí 'those of a judge' (i.e. 'Mukasa's')

The toneless proclitics in question are plural class 2a ba=, locative classes 17 and 18 ku= and mu=, na= 'with, and', and the genitive -aa=, which takes prefixal noun class agreement, e.g. class 8 byaa=. As seen, both they and the first syllable of the PW receive the %L tone.

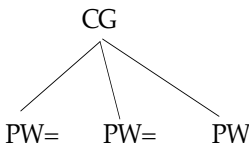
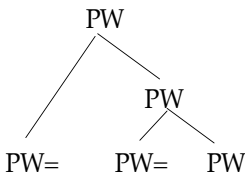
The examples in (52) show that multiple proclitics will all link to the %L tone:

(52) Multiple proclitics show that each begins with a L (as does the base word)

- a. kù= bà= kàtón dá 'on the gods' nà= bà= kàtón dá 'with the gods'
 mù= bà= kàtón dá 'in the gods' byàà= bà= kàtón dá 'those of the gods'
- b. nà= kù= bà= kàtón dá 'and on the gods'
 nà= byàà= bà= kàtón dá 'with those of the gods'
 byàà= kù= bà= kàtón dá 'those on the gods'
 byàà= wàà= bà= kàtón dá 'those of the one of the gods'
- c. nà= byàà= kù= bà= kàtón dá 'with those on the gods'
 nà= byàà= wàà= bà= kàtón dá 'with those of the one of the gods'

In (53) two reasonable tree structures are presented which might account for the multiple realization of the initial %L boundary tone:

(53) Two reasonable structures which might account for proclitic(s) + toneless base words

- a. 
 e.g. [kù= bà= kàtón dá]CG
- b. 
 [[kù= [bà= kàtón dá]PW]PW]PW

(53a) assumes a flat structure, while (53b) assumes a hierarchical structure with internal constituent structure and nested PWs.

To summarize, there are two differences between Shona and Luganda: (i) Meeussen's Rule applies differently: H+H must meet across a clitic-type boundary in Shona, whereas they must not in Luganda; (ii) Prefixes are different from proclitics in Luganda, whereas certain INFL prefixes appear equivalent to proclitics in Shona.

A third difference is that PWs are subject to a bisyllabic minimality condition in Shona (Myers 1995:87), but not in Luganda. Thus, in (46a), the subminimal, monosyllabic nouns /go/ acquire an epenthetic i- prefix to produce the required two syllables:²⁰

(54) Minimality condition on words in Shona is satisfied by i-epenthesis (Myers 1987)

a. noun in isolation	b. with plural prefix	c. with proclitic
i-go 'wasp'	ma-go 'wasps'	ne= gó 'with a wasp'
i-mbá 'house'	dzi-mbá 'houses'	mu= mbá 'in the house'
i-shé 'chief'	vá-she 'chiefs'	ndí= she '(he) is a chief'

Since the plurals have a prefix, there is no epenthetic i- in (54b), nor when the singulars are preceded by a proclitic in (54c). Again, we see the equivalence of proclitics and prefixes in Shona vs. their non-equivalence in Luganda.

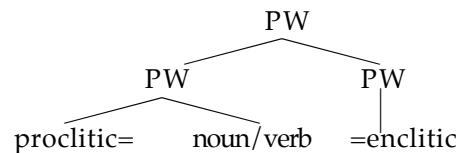
The imperative forms in (55) show that enclitics never count towards satisfying the bisyllabic minimality requirement (Myers 1995:87-88):

(55) Enclitics never count towards the bisyllabic minimality requirement (cf. ku-pá 'give')

a. i-pá 'give!'	*pá	cf. Luganda wâ 'give!'
b. i-pá =i 'give (pl.)!'	*pá =i	
c. i-pá =wo 'give please!'	*pá =wo	
d. i-pá =zve 'give again!'	*pá =zve	

These facts suggest a left-branching PW tree, as in (56).

(56) Left-branching PW tree in Shona



Luganda also requires that proclitics be more tightly bound to their hosts than enclitics. This of course contrasts with what was said about the tighter bond of prefixes vs. suffixes in (20).

A number of other CB languages, show similar bisyllabic word minimality conditions such as Kinande (Mutaka & Hyman 1990), Chichewa (Kanerva 1989) and Ndebele (Downing 2001, Sibanda

2004). Word minimality apparently is not found in NWB, which, as indicated in (57), has a quite different take on prosodic conditions:

(57) Contrast between Central Bantu and Northwest Bantu

Central Bantu	Northwest Bantu
Minimality conditions on words	Maximality conditions on stems
Phrase-penultimate lengthening (> word)	Stem-initial strengthening (accent?)
Prefixes may interact with stem	Prefixes may be quite independent of stem

As we have just seen, certain CB languages place a bisyllabic minimality condition on words. Perhaps related, the penultimate syllable is often said to be prominent in CB. Most of the CB languages which have lost the inherited vowel length contrast lengthen vowels in phrase-penultimate position. (Some narrow this to smaller domains, ultimately the word.) One thinks not only of penultimate stress in Standard Swahili (which has lost its tone), but also languages such as Chizigula, where, as seen in (58b), a H prefixal tone is attracted to penultimate position (unmarked vowels = L tone):

(58) Tonal attraction to penultimate accent in Chizigula (Kenstowicz & Kisseberth 1990:171)

- a. na-ku-gulusa 'I am chasing you' vs. b. a-ku-gulúsa 'he is chasing you'
- |
H

Finally, as we saw in the application of MR in Luganda in (47a), prefixes may interact with the stem phonologically in CB, while their independence from the stem was seen in both Basaa and Kukuya in §5.1.

To summarize this section, we have seen that the word is more varied and elusive within Bantu, as perhaps also outside. Other than the asymmetry between proclitics vs. enclitics indicated in (56), we have also found it harder to establish asymmetries of the sort seen in earlier sections, particularly as characterizing P-stems (§5.1). The examples in (49)-(52) show that it is possible on the basis of tone to distinguish between prefixes and proclitics in Luganda.²¹ However, there do not appear to be segmental differences between what is a possible prefix vs. proclitic in Bantu. In the final section I briefly consider the sometimes special prefix-stem phonology found in and outside Bantu.

6. Prefix-stem fusion

In the preceding sections an attempt has been made to synthesize some of the generalizations that have been demonstrated or claimed concerning directional asymmetries: languages tend to prefer suffixation

over prefixation, segmental assimilations tend to be more anticipatory than perseverative, and strengthening (preservation) and weakening (loss) affect stem-initial and word-final positions, respectively.

A number of explanations have been proposed to account for the claimed generalizations. Smith (2002) proposes that MWord initials are “psycholinguistically strong” because of the importance of initials in early word recognition. Lexical accessing would thus be greatly enhanced if the beginnings of lexical morphemes were clearly demarcated, either segmentally or prosodically (e.g. by stress). The logical endpoint of such a strategy would be to disallow prefixation such that every word begins with a root morpheme. Specifically, prefixes and roots should exhibit a resistance to fusion—rather than a tendency to fuse, as claimed by Greenberg’s (1957), cited in §2.2. While the notion of ex-prefixation was introduced in §5.1, whereby a prefix separates prosodically from its stem, a contradictory tendency was also seen, e.g. in Basaa in §3.3, where a CV prefix fuses with a vowel-initial root to become part of the stem.²²

There are, in fact, two kinds of prefix+stem fusion, both of which obscure prefix-stem demarcation. The first occurs when properties of the prefix are incorporated into the following root. This may occur when the root is vowel-initial, as in Basaa, or consonant-initial, as in the following examples from Tuki, another NWB language:

(59) Prefix features incorporated into stem in Tuki (Hyman 1992)

a.	à-byònò-mí	‘he follows’	b.	à-m-byònò-mí	‘he follows me’
	à-dìngà-mí	‘he loves’		à-n-dìngà-mí	‘he loves me’
	à-fá-mí	‘he gives’		à- <u>p</u> á-mí	‘he gives me’
	à-sèyà-mí	‘he abuses’		à- <u>t</u> sèyà-mí	‘he abuses me’
	à-wúbá-mí	‘he hits’		à- <u>k</u> úbá-mí	‘he hits me’

The forms in (59b) show that the first person object nasal prefix is realized as a nasal before voiced stops, but fuses with the stem-initial continuants /f, s, w/. Numerous Bantu, Austronesian, and other languages restrict various types of N+C modifications to the prefix-stem boundary. Since some of these processes involve deletion of the post-nasal stem-initial consonant, it is unlikely that they are designed to enhance the early recognition of the prefix-stem boundary.²³

The second kind of prefix+stem fusion occurs when features of the root are anticipated onto the prefix. A dramatic example of this occurs in Esimbi. As seen in (60a), the vowel height features of the root shift onto the prefix, here the class 3 archiphoneme /U-/:

(60) Stem features incorporated into prefix in Esimbi (Stallcup 1980, Hyman 1988).

- | | | | | | | | | |
|----|----------|---|-----------|-------------|-----------------|--------|---------|----------------|
| a. | /U-mu/ | → | [u-mu] | 'to drink' | /U-wu/ | → | [u-wu] | 'uproot' |
| | /U-mo/ | → | [o-mu] | 'to go up' | /U-wǒ/ | → | [o-wǔ] | 'burn (intr.)' |
| | /Ú-mə/ | → | [ɔ̣-mu] | 'to sit' | /U-wǒ/ | → | [ɔ̣-wǔ] | 'grind' |
| b. | /U-taŋa/ | → | [ɔ̣-tɪŋi] | 'to count' | cf. Proto-Bantu | *-tán- | | |
| | /U-gaba/ | → | [ɔ̣-gibi] | 'to divide' | cf. Proto-Bantu | *-gàb- | | |

The examples in (60b) further demonstrate that stem vowels must be both high and identical. As in the case of infixation (§3.2), a stem property is realized “out of order”. However, it is difficult to argue that anticipation of vowel height is an aid to early stem recognition when the stems themselves are obscured by the high vowel restriction. While Stallcup hypothesizes that the prefix is accented, this still doesn’t explain why Esimbi doesn’t simply have anticipatory vowel harmony.

Among the evidence cited by Smith (2002) for word-initial prominence are languages which require a word-initial syllable to have an onset. The Niger-Congo languages I have studied that have this property also require a stem-initial syllable to have an onset, e.g. Gokana. In Ndebele, a monosyllabic stem or reduplicant will acquire an epenthetic syllable [yi] to fill out the bisyllabic minimality condition, e.g. /dla/ ‘eat’ → [yidla] ‘eat!’, [dlayi-dla] ‘eat here and there!’ (Hyman, Inkelas & Sibanda 1998, Downing 2001, Sibanda 2004). Since Ndebele also has CV prefix fusion (Sibanda 2004), the correct generalization is that a stem vowel must co-occur with an onset consonant.

The above examples and brief discussion suggest that stem-initial phonology has little, if anything, to do enhancing early stem- or word recognition as an aid to the listener. On the positive

side, the phenomena examined in this paper are compatible with the notion that speakers show priority to stems in lexical accessing and production. Perhaps for their own benefit, speakers preserve, strengthen, *and* anticipate early stem properties, which are made all the earlier by favoring suffixes over prefixes. Such a view is most compatible with the directional- and edge-asymmetries documented above within Bantu and other morphological and phonological systems. It will, however, be crucial to see if the oft-claimed preferences hold up against further testing and a broader, perhaps more systematic database.

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²²In Hyman (1975:222) tone spreading is referred to as “horizontal assimilation” and register adjustment as “vertical assimilation”. Rather than a perseverative bias, the latter shows a pitch gesture asymmetry: /L-H/ frequently becomes [M-H] by anticipatory raising or [L-M] by perseverative lowering, but /H-L/ does not readily become [M-L] or [H-M]. Instead, there is a strong tendency to raise a H tone to superhigh when followed by L. The generalization is that the interval from L to H tends to compress, while the interval from H to L tends to expand.

³The expected form *nokod is instead realized [nok^wad], since [o] is restricted after velars in Mafa.

⁴While I have not done a systematic study, and although both are found, it is my impression that suffixal tones also tend to be more readily incorporated to form stem melodies than prefixal tones. Similarly, postposed lexical floating tones are more robustly attested than preposed: Aghem /-fú/ ‘rat’ vs. /-wó/ ‘hand’. Although this can be attributed to the loss of the final syllable (cf. Proto-Bantu *-bókò ‘arm, hand’), it is significant that lexical representations such as /-’ bò/ are quite rare.

⁵As discussed in Hyman (in press), tone is not subject to root control.

⁶This is particularly true in the case of vowel harmony: “...there seem to be no true cases of Dominant grammatical prefixes which cause harmony to themselves. Apparent counterexamples... are clearly compounds....” (Hall & Hall 1980:227n).

⁷A number of studies use the term “stem-control” instead of “root control”, e.g. Bakovic (2000) and Hansson (2001). Since I need the term “stem” to refer to root+suffixes in §5, I will retain “root-control” here, recognizing that control may be from the root or some combination of root+affixes.

⁸These statements specifically pertain to situations where the harmonizing feature originates in P1, P2, S1 or S2, not where prefixes or suffixes pass on a feature which originates in the root.

⁹Russell (1999) analyzes Dakota as (20b). However, see Rankin, Boyle, Graczyk & Koontz (2002), who discuss the difficulty in determining whether Siouan has suffixes vs. enclitics.

¹⁰Bybee et al hypothesize that this has to do with the greater number of verb-final languages, which, given the natural pathways for grammaticalization, tend to produce suffixes.

¹¹The discussion in this section concerns verbs in Bantu, since they have a more complex morphological structure. As Thilo Schadeberg (pers.comm.) reminds me, the base *taam-* in (21) is itself historically complex, deriving from **tá-* ‘put’ + **-am-*, a frozen positional extension meaning ‘be in a position’, hence **tá-am-* ‘be put’.

¹²Proto-Bantu also had voiceless prenasalized consonants. Since these are less numerous in general, I have omitted them from the table. C_1/C_2 numbers are: **mp* ($\emptyset/2$), **nt* ($1/8$), **nc* ($2/\emptyset$), **ŋk* ($1/9$); there are \emptyset occurring in C_3 position.

¹³Meeussen reconstructs **H/*L*, but another interpretation of **L* is **Ø* (cf. Stevick 1969).

¹⁴Hyman (2004) argues that such prosodic maximality conditions enhance the development of alternative analytic constructions, as West African languages replace head-marking on the verb with dependent-marking on the noun phrase.

¹⁵Stops may also be devoiced before pause. The noun written *mùd* ‘person’ is variably pronounced [mùd], [mùr] or [mùt].

¹⁶When class 8 /*Pi-*/ fuses with a vowel-initial root, the result however is voiced: /*Pi-óm*/ → [g^wóm] ‘things’ (cf. /*Pi-tón*/ → [bì-tón] ‘horns’). This may be because there is a contrastive /*k^w*/ in Basaa.

¹⁷Basaa also restricts the combination of C_2 , C_3 and C_4 consonants. See Hyman (2003b).

¹⁸Another frequent stratum 1 process is the coalescence of **a + *i* to [ee]. This occurs, for instance, when the perfective suffix *-il-* is “imbricated”, as in Cibemba: /*ísal-il-e*/ → *ísail-e* → [íseel-e] ‘close (tr.) + perfective’. In this case, *Ca-* noun prefixes also join the stem, e.g. Ciyao /*ma-ísó*/ → [méésó] ‘eyes’. In all other situations, including *Ca-* verb prefixes, /*a+i*/ is realized [ii]. For an overview of Bantu segmental phonology, see Hyman (2003a).

¹⁹The macrostem is a Bantu-specific domain consisting of an object prefix + verb stem. Where MR does not apply, e.g. between a H tone subject prefix + a H verb root in the subjunctive, Myers assigns both to an extended notion of macrostem. Historically, MR did not apply to **H* tones in sequence. All of Myers’ examples involve forms where a mora with L tone has been lost, e.g. future **kí-à-* > [čá], **ì-pánga* >

[bángá] ‘knife’. The process was one of creating downsteps, followed by lowering: *H-L-H > H-^lH > H-L. By losing these L tone-bearing units, we are left with a synchronic situation where /H-H/ sometimes undergoes MR, sometimes does not.

²⁰From an historical perspective, one could argue that class 5 and 9 *i- was retained only when needed to satisfy the bisyllabic minimality requirement.

²¹Similarly, enclitics can be distinguished from suffixes on the basis of their tonal behavior.

²²One might propose that the CV prefix provides an obligatory onset to the stem. Note, however, that many stems begin with a vowel on the surface, e.g. [éé] ‘tree’, [óó] ‘ear’.

²³Katamba & Hyman (1991) show that in Luganda Meinhof’s Rule will simplify a nasal + voiced stop to a geminate nasal only if the voiced stop belongs to the stem. The rule thus applies not only between a nasal prefix and stem C₁, but also to a nasal + voiced stop appearing totally within the stem. Meinhof’s Rule will not apply if the nasal prefix is followed by a prefix beginning with a voiced stop.