Position classes and morphological theory*

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1. INTRODUCTION

Two generations of linguistics students have cut their teeth on the morphological analysis problem in (1):

- (1) Swahili verb forms (from H. A. Gleason, Jr.'s *Workbook in Descriptive Linguistics* (1955))
atanipenda 'he will like me'	atanipiga 'he will beat me'
atakupenda 'he will like you'	atakupiga 'he will beat you'
atampenda 'he will like him'	atampiga 'he will beat him'
atatupenda 'he will like us'	ananipiga 'he is beating me'
atawapenda 'he will like them'	anakupiga 'he is beating you'
nitakupenda 'I will like you'	anampiga 'he is beating him'
nitampenda 'I will like him'	amekupiga 'he has beaten you'
nitawapenda 'I will like them'	amenipiga 'he has beaten me'
utanipenda 'you will like me'	amempiga 'he has beaten him'
utampenda 'you will like him'	alinipiga 'he beat me'
tutampenda 'we will like him'	alikipiga 'he beat you'
watampenda 'they will like him'	alimpiga 'he beat him'
atakusumbua 'he will annoy you'	wametulipa 'they have paid us'
unamsumbua 'you are annoying him'	tulikulipa 'we paid you'

The problem, of course, is to describe the ordering of the affixes in (1) in terms of POSITION CLASSES: the class of object agreement prefixes occupies the affix position nearest the verb root, the class of tense prefixes occupies the next preceding position, and the class of subject agreement prefixes occupies the word-initial position.

As familiar as this little problem is, morphologists still don't agree on the sort of theory that best accommodates the traditional notion of position class. In this section, I shall exemplify four alternative conceptions of this notion by showing the kinds of solutions they would entail for Gleason's problem. In the first two approaches (which I shall call the PS APPROACHES), the formal resources exploited in accounting for the order of inflectional affixes are essentially those used in accounting for the order of constituents in the domain of syntax, while in the second pair of approaches (the REALIZATIONAL APPROACHES), the ordering of inflectional affixes reflects the sequence in which processes of affixation apply in realizing the set of morphosyntactic feature specifications associated with a root. Ultimately, I shall argue that only one of the four approaches to affix ordering is genuinely adequate.

1.1. *PS approaches to Gleason's Swahili problem*

The PS approaches to morphology are founded on the premise that the rules and representations defining a language's concatenative morphology are analogous to those defining its phrasal syntax. Both at the morphological level and at the syntactic level, the hierarchical structure of linguistic expressions is assumed to follow from a set of context-free rewrite rules; in addition, the basic units in a morphological structure — roots, stems, affixes — are assumed to exist as autonomous entries in a lexicon from which they are inserted into morphological structures in the same way as lexically listed words are inserted into syntactic structures. Thus, in both of the PS approaches, the feature content of an affix is listed with it in its lexical entry.

The first of the two PS approaches makes essential use of subcategorization restrictions in accounting for the distribution of affixes; like the lexical heads in an *Aspects*-style deep structure, affixes are subcategorized for the kinds of constituents they may combine with. The numerous proponents of this SUBCATEGORIZATION APPROACH are quite diverse in their overall theoretical orientation and include Churma (1987), Halle (1990), Jensen and Stong-Jensen (1984), Lieber (1980; 1988; 1989), Marantz (1988), Pesetsky (1985), Sadock (1991), Selkirk (1982: 5), and Sproat (1985). The second PS approach, by contrast, eschews the use of subcategorization restrictions in determining the distribution of affixes in favor of rewrite rules which specify the feature content of each affixal node they introduce. One explicit proposal in favor of this PURE PS APPROACH is that of Selkirk (1982: 71ff).

The two PS approaches differ in their account of the link between the feature content of a word's affixes and that of the word as a whole. In the most familiar versions of the subcategorization approach, the link is established by percolation: a word's feature content is determined by a cyclic amalgamation of the feature specifications carried by its root and affixes (cf. Di Sciullo and Williams (1987), Lieber (1980; 1989), Selkirk (1982: 74ff), Williams (1981)). The precise formulation of this principle of amalgamation generally depends on how one defines the notion 'head' in morphology; the following discussion is, however, neutral with regard to this issue. In the pure PS approach, the link between the feature content of a word's affixes and that of the word as a whole is directly stipulated in the rewrite rules generating that word; thus, percolation has no role in this approach, except perhaps as a kind of well-formedness condition on the rewrite rules themselves.

1.1.1. *The subcategorization approach*

Under the assumptions of the subcategorization approach, Gleason's Swahili problem might be solved as in (2).¹ The recursive rewrite rule (2a) defines a hierarchical structure for each of the verb forms in (1). The lexically listed roots and affixes in (2b)² are then inserted into these structures; the insertion

of the affixes is regulated by the subcategorization restrictions in (2c). These restrictions presume that a verb root is initially unmarked for tense or agreement and that the feature specifications associated with the affixes are added in cyclically. In this way, the word *tulikulipa* 'we paid you' is assigned the structure in (3).

- (2) Gleason's problem solved under the subcategorization approach

a. Rewrite rule: $V \rightarrow Af V$

b. Lexicon: i. Affixes

<i>ni-</i> , Af, [AGR(su):1sg]	<i>ni-</i> , Af, [AGR(ob):1sg]
<i>u-</i> , Af, [AGR(su):2sg]	<i>ku-</i> , Af, [AGR(ob):2sg]
<i>a-</i> , Af, [AGR(su):3sg]	<i>m-</i> , Af, [AGR(ob):3sg]
<i>tu-</i> , Af, [AGR(su):1pl]	<i>tu-</i> , Af, [AGR(ob):1pl]
<i>wa-</i> , Af, [AGR(su):3pl]	<i>wa-</i> , Af, [AGR(ob):3pl]
<i>na-</i> , Af, [TNS:definite]	<i>me-</i> , Af, [TNS:completive]
<i>ta-</i> , Af, [TNS:future]	<i>li-</i> , Af, [TNS:past]

ii. Verb roots

<i>-lipa</i> , V ('pay')	<i>-piga</i> , V ('beat')
<i>-penda</i> , V ('like')	<i>-sumbua</i> , V ('annoy')

c. Subcategorization restrictions:

On subject agreement affixes:

$+[\text{---} \quad V \quad]$
$\left[\begin{array}{l} \text{AGR(su):unmarked} \\ \text{TNS:marked} \\ \text{AGR(ob):marked} \end{array} \right]$

On tense affixes:

$+[\text{---} \quad V \quad]$
$\left[\begin{array}{l} \text{AGR(su):unmarked} \\ \text{TNS:unmarked} \\ \text{AGR(ob):marked} \end{array} \right]$

On object agreement affixes:

$+[\text{---} \quad V \quad]$
$\left[\begin{array}{l} \text{AGR(su):unmarked} \\ \text{TNS:unmarked} \\ \text{AGR(ob):unmarked} \end{array} \right]$

In this approach, the relative ordering of affixes is determined by their subcategorization restrictions; affixes which, in traditional terms, would be regarded as belonging to the same position class are here assigned the same subcategorization restriction.

1.1.2. *The pure PS approach*

Under the assumptions of the pure PS approach, Gleason's problem might be solved as in (4). The rewrite rule in (4a) defines a 'flat' structure for each of the verbs in (1) and itself determines the feature content of the nodes in these structures. Roots and affixes from the lexicon (= (2b)) are inserted into the structure, subject only to the requirement that their feature content match that of the node under which they are inserted. Thus, *tulikulipa* 'we paid you' is assigned the structure in (5).

(4) Gleason's problem solved under the pure PS approach

a. Rewrite rule:

$$\begin{array}{c}
 V \\
 \left[\begin{array}{l} \text{AGR(su):}\alpha \\ \text{TNS:}\beta \\ \text{AGR(ob):}\gamma \end{array} \right]
 \end{array}
 \rightarrow
 \begin{array}{cccc}
 \text{Af} & & \text{Af} & & \text{Af} & & V \\
 \left[\text{AGR(su):}\alpha \right] & & \left[\text{TNS:}\beta \right] & & \left[\text{AGR(ob):}\gamma \right] & &
 \end{array}$$

b. Lexicon (as in (2b))

Because subcategorization plays no role in this account, the restrictions in (2c) are here dispensed with. Thus, the relative ordering of affixes is, in this approach, determined by the rewrite rule (4a); affixes which belong to the same position class on the traditional view are here regarded as being insertable under the same node in the sequence of three affixal nodes generated by (4a).

The analyses in (2) and (4) aren't the only imaginable solutions to Gleason's problem afforded by the PS approaches. For instance, one could imagine an alternative to the subcategorization analysis in (2) in which the recursive rewrite rule in (2a) would be replaced by a rewrite rule which assigned Swahili verbs a flat structure comparable to (5); this would in turn entail obvious differences in the subcategorization restrictions associated with the various affixes. By the same token, one could imagine an alternative version of the pure PS analysis in (4) in which the rewrite rule (4a) would be replaced by a set of rules which, by introducing each of the Af nodes in a Swahili verb at a different bar-level, assigned a layered rather than a flat structure to Swahili verbs. Throughout, my comments concerning the two PS approaches are equally applicable whether one assumes a flat or a layered structure for inflected forms. For concreteness, however, I shall employ layered analyses such as (2) in exemplifying the properties of the subcategorization approach and flat analyses such as (4) in exemplifying the properties of the pure PS approach.

1.2. *Realizational approaches to Gleason's Swahili problem*

In the realizational approaches, the form of a regularly inflected word w is assumed to be uniquely determined by a pairing $\langle [\sigma], r \rangle$, where r is the lexically listed root of w and $[\sigma]$ is the set of morphosyntactic feature specifications associated with w ; in particular, the set $[\sigma]$ of feature specifications is assumed to determine the sequence of inflectional operations by which r is converted to w . In this kind of framework, the feature content associated with an inflectional affix is not specified by lexical listing — indeed, affixes themselves are not even listed in the lexicon but exist only as the charac-

teristic marks left behind after the application of particular inflectional operations; thus, it is the inflectional operations themselves which associate a given affix with its feature content. Moreover, the relation between the feature content of an inflectional affix and that of the word of which it is part is essentially the opposite of a percolation relation: in percolation, the sets of feature specifications which are lexically associated with individual inflectional affixes combine cyclically to yield the set of feature specifications of the word as a whole; in realizational approaches, on the other hand, the feature content of an inflected word is simply given and this determines the sequence of affixes (i.e. affixal operations) that realize that feature content.³ Among the various executions of this idea that have been proposed are those of Matthews (1972), Anderson (1977; 1982; 1986), Zwicky (1985; 1989; 1992), Pullum and Zwicky (to appear), and Stump (1991a; 1991b).

Two different realizational approaches will be examined here; what distinguishes these approaches is the way they explain the ordering of inflectional affixes. In the LINEAR ORDERING APPROACH, inflectional affixes belonging to same position class (in traditional terms) are introduced by a single block of disjunctively ordered rules; thus, the ordering of inflectional affixes is assumed to reflect a fixed linear ordering of the different rule blocks. This conception of affix ordering is implicit in Anderson's (1977) analysis of Potawatomi inflection and subsequent work in the Extended Word-and-Paradigm framework (e.g. Hammond (1981), Platt (1981)). In the PARADIGM FUNCTION APPROACH, on the other hand, the order in which inflectional rules apply is regulated by a system of special rules called paradigm functions; in a system of this sort, the sequence of rule applications by which a given form is inflected may in principle vary according to the feature content associated with that form. In other work (Stump 1991a; to appear), I have argued that the postulation of paradigm functions is necessitated by semantic considerations, and in Stump (1991b), I have demonstrated that they are independently motivated by purely morphological criteria.

1.2.1. *The linear ordering approach*

Under the assumptions of the linear ordering approach, Gleason's Swahili problem might be solved as in (6). (The three rule blocks in (6a–c) are labelled, I, III and IV for consistency with later discussion, in which evidence will be seen for a class of affixes occupying a slot intermediate between I and III.) The block of disjunctively ordered rules in (6a) spells out object agreement prefixes, while the block in (6b) spells out the tense prefixes, and the block in (6c) spells out the subject agreement prefixes. The three rule blocks are linearly ordered as in (6d) and apply in sequence to pairs of the form $\langle [\sigma], r \rangle$, where $[\sigma]$ is a complete, fully specified, and internally consistent set of morphosyntactic features appropriate to Swahili verbs and r is a lexically listed verb root. Given a pair $\langle [\sigma], x \rangle$ (where x is a root or stem)⁴, a rule R is applicable to $\langle [\sigma], x \rangle$ only if $[\tau] \subseteq [\sigma]$ (where $[\tau]$ is the set of morphosyntactic feature specifications realized by R), and the result of applying R to $\langle [\sigma]$,

x is $\langle [\sigma], x' \rangle$ (where x' comes from x by means of the morphological operation associated with R). Thus, the blocks of rules in (6a–c) apply to the pair in (7a) to yield the form *tulikulipa* ‘we paid you’ as in (7b).

(6) Gleason’s problem solved under the linear ordering approach

	OPERATION	REALIZES
a. Block I:	<i>ni</i> -prefixation	[AGR(ob):1sg]
	<i>ku</i> -prefixation	[AGR(ob):2sg]
	<i>m</i> -prefixation	[AGR(ob):3sg]
	<i>tu</i> -prefixation	[AGR(ob):1pl]
	<i>wa</i> -prefixation	[AGR(ob):3pl]
b. Block III:	<i>na</i> -prefixation	[TNS:definite]
	<i>me</i> -prefixation	[TNS:completive]
	<i>li</i> -prefixation	[TNS:past]
	<i>ta</i> -prefixation	[TNS:future]
c. Block IV:	<i>ni</i> -prefixation	[AGR(su):1sg]
	<i>u</i> -prefixation	[AGR(su):2sg]
	<i>a</i> -prefixation	[AGR(su):3sg]
	<i>tu</i> -prefixation	[AGR(su):1pl]
	<i>wa</i> -prefixation	[AGR(su):3pl]

d. Linear ordering of rule blocks: I: III: IV

(7) a.	$\left\langle \begin{bmatrix} \text{AGR(su):1pl} \\ \text{TNS:past} \\ \text{AGR(ob):2sg} \end{bmatrix}, -lipa \right\rangle$	b. Verb root: <i>-lipa</i>
		Block I: <i>ku-lipa</i>
		Block III: <i>li-ku-lipa</i>
		Block IV: <i>tu-li-ku-lipa</i> ‘we paid you’

1.2.2. *The paradigm function approach*

The central assumption which distinguishes the paradigm function approach is that morphological rules are of two distinct types. On the one hand, MORPHOLEXICAL RULES are the individual operations by which complex morphological expressions arise from more basic expressions; in the domain of inflection, a morpholexical rule applies to a root or stem to realize some subset of the morphosyntactic feature specifications associated with it. On the other hand, PARADIGM FUNCTIONS are operations which apply to the root of an inflectional paradigm to yield the various words constituting that paradigm. Paradigm functions are always defined in terms of morpholexical rules, but in heavily inflected languages, a single paradigm function may comprise several distinct morpholexical rules: for instance, the paradigm function which applies to a Swahili verb root to yield that member of its positive past tense paradigm with first person plural subject concord and second person singular object concord comprises three morpholexical rules (corresponding to the three prefixes *ku-*, *li-*, and *tu-*).

I assume the general format in (8) for the statement of morpholexical rules.

- (8) Format for morphological rules: $MLR_{n,[\tau]}(x) = y$
 n = the "slot" or affix position which the rule fills [except in portmanteau morphological rules; see Section 5 below]
 $[\tau]$ = the set of morphosyntactic feature specifications which the rule realizes
 x = the expression to which the rule applies
 y = the result of applying the rule to x

Given this format, the morphological rules necessary to generate the Swahili verb forms in Gleason's problem can be stated as in (9). The five morphological rules in (9a) supply object agreement prefixes appearing in slot I; the four rules in (9b) supply tense prefixes for slot III; and the five rules in (9c) supply subject agreement prefixes for slot IV.

- (9) Morphological rules for a solution to Gleason's problem

a. Morphological rules for slot I

i.	$MLR_{I,[AGR(ob):1sg]}([v\ x])$	$=_{def} [v\ ni- [v\ x]]$
ii.	$MLR_{I,[AGR(ob):2sg]}([v\ x])$	$=_{def} [v\ ku- [v\ x]]$
iii.	$MLR_{I,[AGR(ob):3sg]}([v\ x])$	$=_{def} [v\ m- [v\ x]]$
iv.	$MLR_{I,[AGR(ob):1pl]}([v\ x])$	$=_{def} [v\ tu- [v\ x]]$
v.	$MLR_{I,[AGR(ob):3pl]}([v\ x])$	$=_{def} [v\ wa- [v\ x]]$

b. Morphological rules for slot III

i.	$MLR_{III,[TNS:definite]}([v\ x])$	$=_{def} [v\ na- [v\ x]]$
ii.	$MLR_{III,[TNS:completive]}([v\ x])$	$=_{def} [v\ me- [v\ x]]$
iii.	$MLR_{III,[TNS:past]}([v\ x])$	$=_{def} [v\ li- [v\ x]]$
iv.	$MLR_{III,[TNS:future]}([v\ x])$	$=_{def} [v\ ta- [v\ x]]$

c. Morphological rules for slot IV

i.	$MLR_{IV,[AGR(su):1sg]}([v\ x])$	$=_{def} [v\ ni- [v\ x]]$
ii.	$MLR_{IV,[AGR(su):2sg]}([v\ x])$	$=_{def} [v\ u- [v\ x]]$
iii.	$MLR_{IV,[AGR(su):3sg]}([v\ x])$	$=_{def} [v\ a- [v\ x]]$
iv.	$MLR_{IV,[AGR(su):1pl]}([v\ x])$	$=_{def} [v\ tu- [v\ x]]$
v.	$MLR_{IV,[AGR(su):3pl]}([v\ x])$	$=_{def} [v\ wa- [v\ x]]$

The paradigm functions determine the manner in which these three sets of morphological rules interact in generating the various verb forms in (1). I shall assume the format in (10) for the statement of paradigm functions:

- (10) Format for paradigm functions: $PF_{[\sigma]}(r) = z$
 $[\sigma]$ = the complete and fully specified set of morphosyntactic features associated with z
 r = the root of a paradigm
 z = a word belonging to r 's paradigm

Thus, given a complete, fully specified, and internally consistent set $[\sigma]$ of morphosyntactic features and a lexically listed root r , $PF_{[\sigma]}(r)$ is the fully

inflected word determined by the pair $\langle [\sigma], r \rangle$. As an example, consider the paradigm function which applies to a verb root r to yield that member of r 's positive past tense paradigm with first person plural subject concord and second person singular object concord. In accordance with (10), this paradigm function is represented as $PF_{[\sigma]}$ (where $[\sigma]$ is the set of feature specifications $[AGR(su):1pl, TNS:past, AGR(ob):2sg]$); this function is defined in terms of the three morpholexical rules $MLR_{I,[AGR(ob):2sg]}$, $MLR_{III,[TNS:past]}$, and $MLR_{IV,[AGR(su):1pl]}$ as in (11a). By (11a), *tulikulipa* 'we paid you' is defined as the value of $PF_{[\sigma]}([v \text{ lipa}])$, as in (11b).

- (11) a. Where $[\sigma] = [AGR(su):1pl, TNS:past, AGR(ob):2sg]$,
 $PF_{[\sigma]}([v \text{ x}]) =_{\text{def}} MLR_{IV,[AGR(su):1pl]}(MLR_{III,[TNS:past]}(MLR_{I,[AGR(ob):2sg]}([v \text{ x}])))$
- b. $PF_{[\sigma]}([v \text{ lipa}]) = MLR_{IV,[AGR(su):1pl]}(MLR_{III,[TNS:past]}(MLR_{I,[AGR(ob):2sg]}([v \text{ lipa}])))$
 $= [v \text{ tu- } [v \text{ li- } [v \text{ ku- } [v \text{ lipa}]]]] \text{ 'we paid you'}$

The paradigm functions necessary to characterize other Swahili verb forms in Gleason's problem are parallel to (11a); indeed, it is possible to collapse them into a single paradigm function schema characterizing every verb form in the problem, as in (12).

- (12) Paradigm function schema for a solution to Gleason's problem

$$\text{Where } [\sigma] = [AGR(su): \alpha, TNS: \beta, AGR(ob): \gamma],$$

$$PF_{[\sigma]}([v \text{ x}]) =_{\text{def}} MLR_{IV,[AGR(su): \alpha]}(MLR_{III,[TNS: \beta]}(MLR_{I,[AGR(ob): \gamma]}([v \text{ x}])))$$

From the simple evidence in Gleason's workbook problem, there is no strong reason to prefer any one of these four theories of affix ordering over the others. I shall argue, however, that of the four approaches exemplified above, the paradigm function approach ultimately affords the best account of position class restrictions on inflectional affixes. Elsewhere (Stump 1991b), I have presented arguments for preferring the paradigm function approach to the subcategorization approach; here, I shall focus on a range of problems completely different from those considered in the earlier paper. In particular, I shall discuss: (a) 'ambifixal' position classes in which prefixes and suffixes coexist; (b) 'parallel' position classes — distinct classes in which the same affixal forms are used to express similar feature specifications; (c) 'portmanteau' position classes whose members are portmanteau realizations of an expected affix sequence; and (d) 'reversible' position classes — distinct classes which vary in their ordering with respect to one another. In Sections 2–4, I present examples of ambifixal, parallel, and portmanteau position classes from Swahili; in Section 5, I demonstrate that the paradigm function approach affords an optimal account of all three of these position class phenomena. I then demonstrate that in contrast to the paradigm function approach, the subcategorization approach is in principle incapable of providing an adequate account of ambifixal and parallel position classes (Section 6); the pure PS approach does not afford an adequate account of ambifixal and portmanteau position classes (Section 7); and the linear ordering approach

does not permit an adequate account of parallel and portmanteau position classes (Section 8). In Section 9, I present an example of reversible position classes in Fula. I then demonstrate that the paradigm function approach furnishes a simple account of this phenomenon (Section 10) but that neither the linear ordering approach nor the PS approaches do (Section 11). My conclusions are summarized in Section 12.

2. AMBIFIXAL POSITION CLASSES

According to the traditional conception of position classes, affixes belonging to the same position class exhibit the three properties in (13):

- (13) Traditional assumptions about members of the same position class:
- a. they are in complementary distribution (so that the appearance of one in a given form excludes the appearance of the others in that same form);
 - b. they stand in the same hierarchical relationship to other affixes in the same word;
 - c. they appear in the same linear order with respect to other affixes in the same word.

In addition to the properties in (13), there is a fourth property which members of the same position class exhibit frequently (though not invariably):

- (14) Members of the same position class realize alternative specifications of the same morphosyntactic feature(s).

For example, in Gleason's problem, the Swahili prefixes *li-*, *ta-*, *na-*, and *me-* can be assigned to the same position class because: (i) they never show up in the same verb form; (ii) their distribution is consistent with the assumption that they are always hierarchically "outside of" affixes expressing object agreement but "inside of" affixes expressing subject agreement; (iii) they always precede prefixes expressing object agreement but follow prefixes expressing subject agreement; and (iv) they all realize specifications of the morphosyntactic feature [TNS]. By similar reasoning, a range of different prefixal position classes can be discerned in Swahili verb forms, including the five classes in (15).⁵

- (15) Some prefixal position classes in Swahili verb forms:

<i>Slot V</i>	<i>Slot IV</i>	<i>Slot III</i>	<i>Slot II</i>	<i>Slot I</i>	<i>verb root</i>
negative prefix (nonrelative verb forms)	subject agreement prefixes	tense prefixes; negative prefix (relative verb forms)	relative prefixes	object agreement prefixes	

Consider an example of this sort from Swahili. In relative clauses in which the subject or object has been relativized, Swahili employs a special verb form containing a relative affix which agrees in gender and number with the relativized argument. The inventory of these affixes is given in (16).⁶

GENDER	SINGULAR	PLURAL
M-/WA-	ye	o
M-/MI-	o	yo
KI-/VI-	cho	vyo
Ji-/MA-	lo	yo
N-/N-	yo	zo
U-	o	(none)
U-/N-	o	zo
KU-	ko	(none)

(17) a. mtu a-na-ye-soma
 person(GEN:m-/wa-) AGR(su)-TNS-REL-read
 'a person who is reading'

b. watu wa-na-o-soma
 people(GEN:m-/wa-) AGR(su)-TNS-REL-read
 'people who are reading'

(18) a. kitabu a-na-cho-ki-soma Hamisi
 book(GEN:ki-/vi-) AGR(su)-TNS-REL-AGR(ob)-read Hamisi(GEN:m-/wa-)
 'the book which Hamisi is reading'

b. vitabu a-na-vyo-vi-soma Hamisi
 books(GEN:ki-/vi-) AGR(su)-TNS-REL-AGR(ob)-read Hamisi(GEN:m-/wa-)
 'the books which Hamisi is reading'

(19) a. mtu a-soma-ye
 person(GEN:m-/wa-) AGR(su)-read-REL
 'a person who reads'

- b. watu wa-soma-o
people(GEN:m-/wa-) *AGR*(su)-*read*-REL
 'people who read'
- (20) a. kitabu a-ki-taka-cho Hamisi
book(GEN:ki-/vi-) *AGR*(su)-*AGR*(ob)-*want*-REL *Hamisi*(GEN:m-/wa-)
 'the book which Hamisi wants'
- b. vitabu a-vi-taka-vyo Hamisi
books(GEN:ki-/vi-) *AGR*(su)-*AGR*(ob)-*want*-REL *Hamisi*(GEN:m-/wa-)
 'the books which Hamisi wants'
- (21) a. mtu a-si-ye-soma
person(GEN:m-/wa-) *AGR*(su)-*NEG*-REL-*read*
 'a person who doesn't read'
- b. watu wa-si-o-soma
people(GEN:m-/wa-) *AGR*(su)-*NEG*-REL-*read*
 'people who don't read'
- (22) a. kitabu a-si-cho-ki-taka Hamisi
book(GEN:ki-/vi-) *AGR*(su)-*NEG*-REL-*AGR*(ob)-*want* *Hamisi*(GEN:m-/wa-)
 'the book which Hamisi doesn't want'
- b. vitabu a-si-vyo-vi-taka Hamisi
books(GEN:ki-/vi-) *AGR*(su)-*NEG*-REL-*AGR*(ob)-*want* *Hamisi*(GEN:m-/wa-)
 'the books which Hamisi doesn't want'

In most of these examples, the relative affix is positioned prefixally, immediately after a slot III prefix (before the object agreement prefix, if there is one); in (19) and (20), however, the relative affix is instead suffixed to the verb root. The generalization is that the relative affix appears prefixally in forms which are either marked for tense or are negative in polarity, but appears suffixally in forms which are both tenseless and positive.⁸

Now, what is interesting about the prefixal and suffixal relative affixes is that they are like members of a traditional position class except that they don't appear in the same linear order. That is, even though some relative affixes are prefixes and others are suffixes, the appearance of any relative affix (whether prefixal or suffixal) excludes that of any other relative affix; in addition, all relative affixes can be assumed to appear hierarchically "outside of" affixes expressing object agreement but "inside of" affixes expressing subject agreement, tense, or negative polarity; and all relative affixes realize specifications of the morphosyntactic feature of relative concord. Thus, the Swahili relative affixes exhibit properties (13a, b) (as well as (14)) but not (13c).

In order to account for this fact in a theory of morphology, one could assume that the notion of position class is defined independently of the linear ordering of affixes; that is, one could assume that of the properties listed in

(13), only (13a, b) are necessary properties of position classes, and that (13c), like (14), is merely a contingent property of certain position classes.⁹ On this view, the Swahili relative affixes would constitute an AMBIFIXAL POSITION CLASS (one that is neither purely prefixal nor purely suffixal), and the 'slot' which they fill in a verb's layer of inflectional morphology would have to be viewed as a position in the hierarchical organization of an inflected form's affixes rather than as a position in the linear sequence of affixes.

The postulation of ambifixal position classes is motivated independently by abundant evidence in other languages. Consider an additional example from Fula. In each of the tenses in (23), Fula verbs exhibit contrasting preterite and non-preterite forms. Preterite forms are marked with a special affix *no(o)*; in forming the preterite forms of the tenses in (23a), *no(o)* is suffixed (as in (24a)) but in forming the preterite forms of the tenses in (23b), it is instead prefixed (as in (24b)); thus, prefixal *no(o)*- and suffixal *-no(o)* are mutually exclusive in distribution — when one shows up in a given preterite verb form, the other does not. Moreover, in both its prefixal and its suffixal guises, the distribution of *no(o)* is consistent with the assumption that it is hierarchically "inside of" all subject and object agreement affixes but "outside of" all tense affixes.¹⁰ Thus, like the Swahili relative affixes, prefixal and suffixal *no(o)* constitute an ambifixal position class.

(23) Fula tenses participating in the preterite/non-preterite distinction

- a. general past, emphatic past, general future, negative past, negative future, and negative of quality, relative past, relative future
- b. first stative, first continuous

(24) Examples of non-preterite vs preterite forms in Fula (Arnott 1970: 216f)

	TENSE/VOICE	NON-PRETERITE	PRETERITE
a.	General past	'o-warii	'o-warii-no
	active	<i>AGR(su)-come:TNS</i> 'he came'	<i>AGR(su)-come:TNS-PRET</i> 'he had come'
b.	1st continuous	'odon-wara	'odon-no-wara
	active	<i>AGR(su)-come:TNS</i> 'he is coming'	<i>AGR(su)-PRET-come:TNS</i> 'he was coming'

In both the Fula and Swahili examples, the ambifixal position class consists of what might be called AMBIFIXAL PAIRS: prefix/suffix pairs whose members are identical in phonological form and seem to encode the same morphosyntactic feature specification(s). Nevertheless, an ambifixal position class may instead consist of unpaired affixes. As an example, consider the Fula subject agreement affixes in (25). This is the set of subject agreement

affixes employed in the relative past and relative future tenses and in the subjunctive, as in the examples in (26).

(25) Personal subject agreement affixes in Fula (relative past, relative future, subjunctive)¹¹

PERSON	SINGULAR AFFIXES			PLURAL AFFIXES	
	PREFIXAL	SUFFIXAL		PREFIXAL	SUFFIXAL
1	mi- ^a	-mi ^b		min-	
2		-aa ^c , -ɗaa ^d	INCLUSIVE:		-en ^c , -ɗen ^d
			EXCLUSIVE:		-on ^c , -ɗon ^d
3 CLASS 1:	'o-		CLASS 2:	be-	

^a in subjunctive forms

^b in the relative tenses

^c in subjunctive active and relative future active forms

^d in middle and passive forms of the subjunctive and of the relative future; in the relative past

(26) Partial paradigm of *loot*- 'wash' (Arnott (1970: 191–192))

PERSON/NUMBER	RELATIVE PAST			SUBJUNCTIVE		SUBJUNCTIVE
	ACTIVE			ACTIVE		MIDDLE
1SG		lootu	-mi	mi-	loota	mi- lootoo
2SG		lootu	-ɗaa		loot -aa	looto -ɗaa
3SG/CLASS 1	'o-	looti		'o-	loota	'o- lootoo
1PL	min-	looti		min-	loota	min- lootoo
2PL INCLUSIVE		lootu	-ɗen		loot -en	lootoo -ɗen
2PL EXCLUSIVE		lootu	-ɗon		loot -on	lootoo -ɗon
3PL/CLASS 2	be-	looti		be-	loota	be- lootoo

Although the affixes in (25) are partly prefixal and partly suffixal, they jointly satisfy criteria (13a, b): the appearance of any one of these affixes in a given verb form excludes the appearance of the others; moreover, their distribution is consistent with the conclusion that they occupy the same hierarchical position relative to a verb's other inflections, appearing "outside of" the preterite affix and "inside of" any object affixes, as in (27).¹²

- (27) mballu-noo-mi-be
help:REL:PAST:ACT-PRET-I-them:CL.2
 'I had helped them'

In addition, they exhibit property (14), since they all encode person and number. Thus, the affixes in (25) constitute an ambifixal position class, despite the fact that (with the sole exception of the first person singular affixes) they aren't organized into ambifixal pairs.

A final question concerning the analysis of ambifixal position classes is whether the members of an ambifixal pair should be regarded as different

instances of a single affix or as distinct but related affixes. In considering this question, it is important to note that the members of an ambifixal pair are generally uneven in their distribution: one member of the pair appears in a restricted range of environments while the other appears in a broader range of environments. For instance, the Swahili relative affixes appear as verbal suffixes in only one environment (positive tenseless relative verb forms) and as verbal prefixes elsewhere (in relative verb forms which are tensed or negative). Similarly, the Fula preterite affix *no(o)* appears as a prefix in the first stative and first continuous tenses only and as a suffix elsewhere (in all of the tenses listed in (23a)). These facts suggest that the less widely distributed member of an ambifixal pair is more narrowly specified in its feature content and that the more widely distributed member functions as a default. On this reasoning, the Swahili relative suffixes could be assumed to realize the feature specifications of tenselessness and positive polarity as well as that of relative concord; the relative prefixes, by contrast, would then be assumed to function as default realizations of relative concord.¹³ This analysis presumes that the members of an ambifixal pair are distinct affixes with distinct feature content; I shall tentatively assume that this is so. Nevertheless, I shall return in Section 7 and again in the appendix to the possibility of a 'single affix' approach to ambifixal pairs.

3. PARALLEL POSITION CLASSES

Ambifixal position classes contrast interestingly with another phenomenon commonly observed in languages with position class morphology, namely that of PARALLEL POSITION CLASSES. Two distinct position classes associated with distinct hierarchical positions will be said to be parallel just in case the same feature specifications are recurrently expressed by means of the same affixes in both classes. As an example of parallel position classes, consider the prefixes expressing subject agreement and object agreement in Swahili:¹⁴

(28) Subject and object agreement prefixes in Swahili

PERSON	GENDER	SUBJECT PREFIXES		OBJECT PREFIXES	
		SINGULAR	PLURAL	SINGULAR	PLURAL
1		ni-	tu-	ni-	tu-
2		u-	m-	ku-	wa-
3:	M-/WA-	a-	wa-	m-	wa-
	M-/MI-	u-	i-	u-	i-
	KI-/VI-	ki-	vi-	ki-	vi-
	JI-/MA-	li-	ya-	li-	ya-
	N-/N-	i-	zi-	i-	zi-
	U-	u-	(none)	u-	(none)
	U-/N-	u-	zi-	u-	zi-
	KU-	ku-	(none)	ku-	(none)

As the examples in Gleason's problem show, subject agreement prefixes and object agreement prefixes constitute distinct position classes, corresponding to distinct slots in the makeup of Swahili verb forms (i.e. slots IV and I). Nevertheless, there is a striking parallelism of form and content between the affixes in these classes, as a comparison of the four columns in (28) reveals: the subject agreement prefix is identical in form to the corresponding object agreement prefix in all but three instances. In realizational terms, the formal operation by which the feature specification $[AGR(su):\alpha]$ is realized is in nearly all cases identical to that by which the feature specification $[AGR(ob):\alpha]$ is realized, even though the two operations fill different slots.

4. PORTMANTEAU POSITION CLASSES

A third phenomenon frequently encountered in the analysis of position class systems is the incidence of PORTMANTEAU POSITION CLASSES — that is, classes whose members are individual affixes which appear in place of some expected sequence of affixes. Consider, for example, the partial paradigm of the Swahili verb *taka* 'want' in (29): in this paradigm, *ni-* ordinarily shows up in slot IV as the first person singular subject agreement prefix and *ha-* ordinarily appears in slot V as the negative prefix; yet, in negative verb forms with first person singular subjects, a prefix *si-*¹⁵ appears in place of the expected sequence *ha-ni-*, producing forms such as *si-ta-taka* 'I will not want' in place of expected forms such as **ha-ni-ta-taka*. Because the prefix *si-* is mutually exclusive both with the slot V prefix *ha-* and with all of the ordinary subject agreement prefixes occupying slot IV, there is no good distributional basis for choosing either slot over the other as the location of *si-*. Moreover, as an exponent both of negative polarity and of first person singular subject agreement, *si-* represents the union of the feature content of *ha-* with that of *ni-*; in other words, its content likewise fails to place it clearly in either slot IV or slot V. In view of these facts, it is plausible to assume that *si-* simultaneously occupies both slots, precluding the appearance of any other affix in either slot; that is, *si-* should be viewed as the sole member of a portmanteau position class pre-empting slots V and IV (cf. Zwicky (1992: 353)).

- (29) Partial inflectional paradigm of Swahili *taka* 'to want' (Ashton 1944: 70ff)

a. Past tense

POSITIVE			NEGATIVE		
	IV	III		V	IV III
1SG	ni-	li- taka	1SG	si-	ku- taka
2SG	u-	li- taka	2SG	ha- u-	ku- taka (→ hukutaka)
3SG	a-	li- taka	3SG	ha- a-	ku- taka (→ hakutaka)
1PL	tu-	li- taka	1PL	ha- tu-	ku- taka
2PL	m-	li- taka	2PL	ha- m-	ku- taka
3PL	wa-	li- taka	3PL	ha- wa-	ku- taka

b. Future tense

POSITIVE			NEGATIVE		
	IV	III		V	IV III
1SG	ni-	ta- taka	1SG	si-	ta- taka
2SG	u-	ta- taka	2SG	ha- u-	ta- taka (→ hutataka)
3SG	a-	ta- taka	3SG	ha- a-	ta- taka (→ hatataka)
1PL	tu-	ta- taka	1PL	ha- tu-	ta- taka
2PL	m-	ta- taka	2PL	ha- m-	ta- taka
3PL	wa-	ta- taka	3PL	ha- wa-	ta- taka

5. ACCOUNTING FOR AMBIFIXAL, PARALLEL, AND PORTMANTEAU POSITION CLASSES IN THE PARADIGM FUNCTION APPROACH

The paradigm function approach straightforwardly accommodates the notions of ambifixal, parallel, and portmanteau position classes; as I now show, the paradigm function analysis given in (30) provides an optimal account of the Swahili data just discussed. Before the details of this analysis can be examined, however, three additional assumptions must be carefully noted.

(30) A paradigm function analysis of Swahili verb forms (partial)

A. *Morpholexical rules for slot I*A1. $\text{MLR}_{\text{I}, [\text{AGR}(\text{ob}): \text{PERS}:2, \text{NUM}:\text{sg}, \text{GEN}:\text{m}/\text{wa}]}([\text{v } x]) =_{\text{def}} [\text{v } \text{ku } [\text{v } x]]$ A2. $\text{MLR}_{\text{I}, [\text{AGR}(\text{ob}): \text{PERS}:3, \text{NUM}:\text{sg}, \text{GEN}:\text{m}/\text{wa}]}([\text{v } x]) =_{\text{def}} [\text{v } \text{m } [\text{v } x]]$ A3. $\text{MLR}_{\text{I}, [\text{AGR}(\text{ob}): \text{PERS}:2, \text{NUM}:\text{pl}, \text{GEN}:\text{m}/\text{wa}]}([\text{v } x]) =_{\text{def}} [\text{v } \text{wa } [\text{v } x]]$ B. *Morpholexical rules for slot II (in which $\mu = \text{su}$ or ob)*B1. $\text{MLR}_{\text{II}, [\text{REL}(\mu): \text{NUM}:\text{sg}, \text{GEN}:\text{m}/\text{wa}]}([\text{v } x]) =_{\text{def}} [\text{v } \text{ye } [\text{v } x]]$ B2. $\text{MLR}_{\text{II}, [\text{REL}(\mu): \text{NUM}:\text{sg}, \text{GEN}:\text{ki}/\text{vi}]}([\text{v } x]) =_{\text{def}} [\text{v } \text{cho } [\text{v } x]]$ B3. $\text{MLR}_{\text{II}, [\text{REL}(\mu): \text{NUM}:\text{pl}, \text{GEN}:\text{m}/\text{wa}]}([\text{v } x]) =_{\text{def}} [\text{v } \text{o } [\text{v } x]]$ B4. $\text{MLR}_{\text{II}, [\text{REL}(\mu): \text{NUM}:\text{pl}, \text{GEN}:\text{ki}/\text{vi}]}([\text{v } x]) =_{\text{def}} [\text{v } \text{vyo } [\text{v } x]]$ C. *Morpholexical rules for slot III (in which $\mu = \text{su}$ or ob)*C1. $\text{MLR}_{\text{III}, [\text{TNS}:\text{definite}]}([\text{v } x]) =_{\text{def}} [\text{v } \text{na } [\text{v } x]]$ C2. $\text{MLR}_{\text{III}, [\text{TNS}:\text{future}]}([\text{v } x]) =_{\text{def}} [\text{v } \text{ta } [\text{v } x]]$ C3. $\text{MLR}_{\text{III}, [\text{TNS}:\text{future}, \text{REL}(\mu): \text{NUM}:\alpha, \text{GEN}:\beta]}([\text{v } x]) =_{\text{def}} [\text{v } \text{taka } [\text{v } x]]$ C4. $\text{MLR}_{\text{III}, [\text{TNS}:\text{past}]}([\text{v } x]) =_{\text{def}} [\text{v } \text{li } [\text{v } x]]$ C5. $\text{MLR}_{\text{III}, [\text{POL}:\text{neg}, \text{TNS}:\text{past}]}([\text{v } x]) =_{\text{def}} [\text{v } \text{ku } [\text{v } x]]$ C6. $\text{MLR}_{\text{III}, [\text{POL}:\text{neg}, \text{REL}(\mu): \text{NUM}:\alpha, \text{GEN}:\beta]}([\text{v } x]) =_{\text{def}} [\text{v } \text{si } [\text{v } x]]$ D. *Morpholexical rules for slot IV*D1. $\text{MLR}_{\text{IV}, [\text{AGR}(\text{su}): \text{PERS}:2, \text{NUM}:\text{sg}, \text{GEN}:\text{m}/\text{wa}]}([\text{v } x]) =_{\text{def}} [\text{v } \text{u } [\text{v } x]]$ D2. $\text{MLR}_{\text{IV}, [\text{AGR}(\text{su}): \text{PERS}:3, \text{NUM}:\text{sg}, \text{GEN}:\text{m}/\text{wa}]}([\text{v } x]) =_{\text{def}} [\text{v } \text{a } [\text{v } x]]$ D3. $\text{MLR}_{\text{IV}, [\text{AGR}(\text{su}): \text{PERS}:2, \text{NUM}:\text{pl}, \text{GEN}:\text{m}/\text{wa}]}([\text{v } x]) =_{\text{def}} [\text{v } \text{m } [\text{v } x]]$ E. *Morpholexical rule for slot V (in which $\mu = \text{su}$ or ob)* $\text{MLR}_{\text{V}, [\text{POL}:\text{neg}, \text{REL}(\mu):\text{none}]}([\text{v } x]) =_{\text{def}} [\text{v } \text{ha } [\text{v } x]]$

- F. *Morpholexical metarule for slot II* (in which $\mu = \text{su or ob}$)
 $\text{MLR}_{\text{II}, [\text{REL}(\mu): \alpha]}(x) =_{\text{def}} [v \ y \ x]$
 $\Downarrow$
 $\text{MLR}_{\text{II}, [\text{TNS: none, POL: pos, REL}(\mu): \alpha]}(x) =_{\text{def}} [v \ x \ y]$
- G. *Morpholexical rules for slots IV and I* (in which g is the function $\langle \langle \text{su, IV} \rangle, \langle \text{ob, I} \rangle \rangle$)
- G1. $\text{MLR}_{g(\mu), [\text{AGR}(\mu): [\text{PERS: 1, NUM: sg, GEN: m/wa}]]}([v \ x]) =_{\text{def}} [v \ \text{ni} \ [v \ x]]$
 G2. $\text{MLR}_{g(\mu), [\text{AGR}(\mu): [\text{PERS: 3, NUM: sg, GEN: ki/vi}]]}([v \ x]) =_{\text{def}} [v \ \text{ki} \ [v \ x]]$
 G3. $\text{MLR}_{g(\mu), [\text{AGR}(\mu): [\text{PERS: 1, NUM: pl, GEN: m/wa}]]}([v \ x]) =_{\text{def}} [v \ \text{tu} \ [v \ x]]$
 G4. $\text{MLR}_{g(\mu), [\text{AGR}(\mu): [\text{PERS: 3, NUM: pl, GEN: m/wa}]]}([v \ x]) =_{\text{def}} [v \ \text{wa} \ [v \ x]]$
 G5. $\text{MLR}_{g(\mu), [\text{AGR}(\mu): [\text{PERS: 3, NUM: pl, GEN: ki/vi}]]}([v \ x]) =_{\text{def}} [v \ \text{vi} \ [v \ x]]$
- H. *Portmanteau morpholexical rule for slots V and IV* (in which $\mu = \text{su or ob}$)
 $\text{MLR}_{(V \circ IV), [\text{POL: neg, AGR}(\text{su}): [\text{PERS: 1, NUM: sg, GEN: m/wa}], \text{REL}(\mu): \text{none}]}([v \ x])$
 $=_{\text{def}} [v \ \text{si} \ [v \ x]]$
- I. *Paradigm function schema* (in which $\mu = \text{su or ob}$)
 Where $[\sigma] = [\text{AGR}(\text{su}): \alpha, \text{TNS}: \beta, \text{POL}: \gamma, \text{REL}(\mu): \delta, \text{AGR}(\text{ob}): \varepsilon]$,
 $\text{PF}_{[\sigma]}([v \ x]) =_{\text{def}} \text{MLF}_{(V \circ IV), [\sigma]}(\text{MLF}_{\text{III}, [\sigma]}(\text{MLF}_{\text{II}, [\sigma]}(\text{MLF}_{\text{I}, [\sigma]}([v \ x])))$
 or: $=_{\text{def}} \text{MLF}_{((V \circ IV) \circ (\text{III} \circ (\text{II} \circ \text{I})), [\sigma]}([v \ x])$

First, I shall assume that Swahili verb forms carry specifications for five features, and that the permissible values for these features are as in (31a); note that the features $[\text{AGR}(\text{su})]$, $[\text{AGR}(\text{ob})]$, and $[\text{REL}(\mu)]$ have sets of auxiliary feature specifications as their values, and that the permissible values for these auxiliary features are as in (31b).¹⁶ The values of the feature $[\text{GEN}]$ are genders: where α and β are the singular and plural noun class prefixes associated with a given gender, the gender itself is referred to mnemonically as ' α/β '. In addition, I shall assume that the feature specifications carried by Swahili relative verb forms are subject to the cooccurrence restrictions in (32); according to these restrictions, negative relative verb forms are always tenseless, and the value of the $[\text{REL}(\mu)]$ feature must agree in number and gender with either the value of $[\text{AGR}(\text{su})]$ or that of $[\text{AGR}(\text{ob})]$.

(31) Permissible values for features

FEATURE	PERMISSIBLE VALUES
a. $[\text{AGR}(\text{su})]$	any permissible specification of the set of features $[\text{PERS}, \text{NUM}, \text{GEN}]$
$[\text{TNS}]$	'definite', 'past', 'future', or 'none'
$[\text{POL}]$	'pos', 'neg'
$[\text{REL}(\mu)]$	any permissible specification of the set of features $[\text{NUM}, \text{GEN}]$ or 'none'
$[\text{AGR}(\text{ob})]$	any permissible specification of the set of features $[\text{PERS}, \text{NUM}, \text{GEN}]$ or 'none'

- b. [PERS] '1', '2', '3'
 [NUM] 'sg', 'pl'
 [GEN] 'm/wa', 'ki/vi'

(32) Cooccurrence restrictions on feature specifications of relative verb forms

- a. $[\text{REL}(\mu):[\text{NUM}:\alpha, \text{GEN}:\beta]] \supset ([\text{POL}:\text{neg}] \supset [\text{TNS}:\text{none}])$
 b. $[\text{REL}(\mu):[\text{NUM}:\alpha, \text{GEN}:\beta]] \supset [\text{AGR}(\mu):[\text{PERS}:\gamma, \text{NUM}:\alpha, \text{GEN}:\beta]]$ (where $\mu = \text{su}$ or ob)

The second important assumption underlying the analysis of Swahili verb morphology in (30) is that in at least some cases, paradigm functions are not defined directly in terms of morpholexical rules but may instead be defined indirectly by means of a related sort of construct which I shall call MORPHOLEXICAL FUNCTIONS. For each slot n in a word's layer of inflectional morphology, the set of morpholexical rules which compete to fill slot n determines a single morpholexical function; when this function applies to an expression paired with a complete and fully specified set of morphosyntactic features, its value is the result of filling slot n by means of the appropriate morpholexical rule. The format for morpholexical functions will ordinarily be as in (33a) and the value of any such function is assumed to be ordinarily determined by the two principles in (33b).¹⁷

(33) Morpholexical functions

- a. Format: $\text{MLF}_{n,[\sigma]}(x) = y$
 n = the "slot" or affix position which the function fills [except in portmanteau morpholexical functions; see below]
 $[\sigma]$ = the complete and fully specified set of morphosyntactic features associated with x
 x = the expression to which the function applies
 y = the result of applying the function to x
- b. The value of $\text{MLF}_{n,[\sigma]}(x)$ is determined by:
- i. The MAXIMAL SUBSET OVERRIDE: If there is a morpholexical rule $\text{MLR}_{n,[\tau]}$ such that $[\tau] \subseteq [\sigma]$ and there is no distinct morpholexical rule $\text{MLR}_{n,[\tau']}$ such that $[\tau'] \subseteq [\sigma]$ and $[\tau] \subseteq [\tau']$, then $\text{MLF}_{n,[\sigma]}(x) = \text{MLR}_{n,[\tau]}(x)$.
 - ii. The IDENTITY FUNCTION DEFAULT: the value of $\text{MLF}_{n,[\sigma]}(x)$ defaults to x .

A couple of concrete examples will help clarify the effects of these two principles. Consider first the example in (34) illustrating the Maximal Subset Override. The six morpholexical rules in (30)C determine the morpholexical function MLF_{III} ; when this function applies to an expression paired with a

complete and fully specified set of morphosyntactic features, its value is the result of filling slot III by means of the relevant morpholexical rule from (30)C. Suppose now that MLF_{III} applies to the verb root *taka* 'want' paired with the set $[\sigma]$ of feature specifications in (34a). Note that two different morpholexical rules in (30)C realize a subset of $[\sigma]$, namely the past tense rule *C4* and the negative past tense rule *C5*; of these two, *C5* realizes the larger subset and is therefore selected by the Maximal Subset Override to determine the value of MLF_{III} , as in (34b).

- (34) a. $[_v \text{ taka}], [\sigma] \quad [\sigma] = \begin{bmatrix} \text{AGR}(\text{su}):[\text{PERS}:1, \text{NUM}:\text{pl}, \text{GEN}:\text{m/wa}], \text{TNS}:\text{past}, \\ \text{POL}:\text{neg}, \text{REL}(\mu):\text{none}, \text{AGR}(\text{ob}):\text{none} \end{bmatrix}$
- b. By the Maximal Subset Override, $MLF_{III, [\sigma]}([_v \text{ taka}])$
 $= MLR_{III, [\text{POL}:\text{neg}, \text{TNS}:\text{past}]}([_v \text{ taka}]) = [_v \text{ ku } [_v \text{ taka}]]$
 $\neq MLR_{III, [\text{TNS}:\text{past}]}([_v \text{ taka}]) = [_v \text{ li } [_v \text{ taka}]]$

Now consider an example illustrating the Identity Function Default. The three morpholexical rules in (30)A together with the five rules in (30)G determine the morpholexical function MLF_I . Suppose now that MLF_I applies to the verb root *taka* 'want' paired with the set $[\sigma]$ of feature specifications in (35a). Note that because none of the morpholexical rules in (30)A, *G* realizes a subset of $[\sigma]$, the Maximal Subset Override does not supply a value for MLF_I in this case; for this reason, MLF_I is in this instance simply evaluated as the identity function, as in (35b).

- (35) a. $[_v \text{ taka}], [\sigma] \quad [\sigma] = \begin{bmatrix} \text{AGR}(\text{su}):[\text{PERS}:1, \text{NUM}:\text{pl}, \text{GEN}:\text{m/wa}], \text{TNS}:\text{past}, \\ \text{POL}:\text{pos}, \text{REL}(\mu):\text{none}, \text{AGR}(\text{ob}):\text{none} \end{bmatrix}$
- b. By the Identity Function Default, $MLF_{I, [\sigma]}([_v \text{ taka}]) = [_v \text{ taka}]$

The third important assumption underlying the proposed analysis is the existence of PORTMANTEAU MORPHOLEXICAL RULES which spell out affixes that pre-empt sequences of two or more position classes. To provide for rules of this sort, the format for morpholexical rules proposed earlier in (8) must be broadened somewhat: henceforth, I shall assume that in a morpholexical rule ' $MLR_{n, [\tau]}(x) = y$ ', the subscript n may be any member of the smallest set N such that (a) $i \in N$ if i is an affix position and (b) $(j \circ k) \in N$ if $j, k \in N$. The effect of this revised format is to allow morpholexical rules such as (30)H, which is indexed not for a single affix position but for the 'composite' of two affix positions, namely slots IV and V. This broadened format for morpholexical rules entails a broadened conception of both the format and evaluation of morpholexical functions. Thus, just as the morpholexical rules in (30)C determine a morpholexical function MLF_{III} which fills slot III, the portmanteau morpholexical rule in (30)H is assumed to determine a portmanteau morpholexical function $MLF_{(V \circ IV)}$ which fills the 'composite' of slots IV and V; more generally, I assume henceforth that in a morpholexical function ' $MLF_{n, [\sigma]}(x) = y$ ', the subscript n may be any member of the smallest set N of which both (a) and (b) above hold true. Like

'ordinary' morpholexical functions, portmanteau morpholexical functions are evaluated in accordance with the Maximal Subset Override; they differ, however, in that their default value is determined not by the Identity Function Default, but by an additional principle which I shall call the FUNCTION COMPOSITION DEFAULT, whose definition is given in (36).

- (36) The FUNCTION COMPOSITION DEFAULT: the value of $\text{MLF}_{(m \circ n),[\sigma]}(x)$ defaults to $\text{MLF}_{m,[\sigma]}(\text{MLF}_{n,[\sigma]}(x))$.

To understand the effect of the Function Composition Default, consider the example in (37). The portmanteau morpholexical rule in (30)*H* determines the portmanteau morpholexical function $\text{MLF}_{(V \circ IV)}$; the morpholexical rule in (30)*E* determines the morpholexical function MLF_V ; and the eight morpholexical rules in (30)*D*, *G* determine the morpholexical function MLF_{IV} . When $\text{MLF}_{(V \circ IV)}$ applies to an expression paired with a complete and fully specified set of morphosyntactic features, its value is determined either by the Maximal Subset Override or by the Function Composition Default. Suppose, on the one hand, that $\text{MLF}_{(V \circ IV)}$ applies to the negative past tense verb stem *kutaka* 'didn't want' paired with the set $[\sigma]$ of feature specifications in (37a): in this case, the value of $\text{MLF}_{(V \circ IV)}$ is supplied by the morpholexical rule in (30)*H*, as in (37b); the Maximal Subset Override requires this, since rule (30)*H* realizes a subset of $[\sigma]$. Suppose, on the other hand, that $\text{MLF}_{(V \circ IV)}$ applies to *kutaka* paired with the set $[\sigma']$ of feature specifications in (37c): since there is no morpholexical rule in (30)*H* which realizes any subset of $[\sigma']$, the Maximal Subset Override fails to determine a value for $\text{MLF}_{(V \circ IV)}$ in this case; for this reason, the Function Composition Default instead causes $\text{MLF}_{(V \circ IV)}$ to be evaluated as the composite of MLF_{IV} with MLF_V , as in (37d).

- (37) a. $[_V \text{ ku } [_V \text{ taka}]], [\sigma] \quad [\sigma] = \begin{bmatrix} \text{AGR}(\text{su}):[\text{PERS}:1, \text{NUM}:\text{sg}, \text{GEN}:\text{m}/\text{wa}], \text{TNS}:\text{past}, \\ \text{POL}:\text{neg}, \text{REL}(\mu):\text{none}, \text{AGR}(\text{ob}):\text{none} \end{bmatrix}$
- b. By the Maximal Subset Override, $\text{MLF}_{(V \circ IV),[\sigma]}([_V \text{ ku } [_V \text{ taka}]])$
 $= \text{MLR}_{(V \circ IV),[\text{POL}:\text{neg}, \text{AGR}(\text{su}):[\text{PERS}:1, \text{NUM}:\text{sg}, \text{GEN}:\text{m}/\text{wa}], \text{REL}(\mu):\text{none}]}([_V \text{ ku } [_V \text{ taka}]])$
 $= [_V \text{ si } [_V \text{ ku } [_V \text{ taka}]]]$
- c. $[_V \text{ ku } [_V \text{ taka}]], [\sigma'] \quad [\sigma'] = \begin{bmatrix} \text{AGR}(\text{su}):[\text{PERS}:1, \text{NUM}:\text{pl}, \text{GEN}:\text{m}/\text{wa}], \text{TNS}:\text{past}, \\ \text{POL}:\text{neg}, \text{REL}(\mu):\text{none}, \text{AGR}(\text{ob}):\text{none} \end{bmatrix}$
- d. By the Function Composition Default, $\text{MLF}_{(V \circ IV),[\sigma']}([_V \text{ ku } [_V \text{ taka}]])$
 $= \text{MLR}_{V,[\text{POL}:\text{neg}, \text{REL}(\mu):\text{none}]}(\text{MLR}_{IV,[\text{AGR}(\text{su}):[\text{PERS}:1, \text{NUM}:\text{pl}, \text{GEN}:\text{m}/\text{wa}]}([_V \text{ ku } [_V \text{ taka}]])$
 $= [_V \text{ ha } [_V \text{ tu } [_V \text{ ku } [_V \text{ taka}]]]]$

Note that because the Function Composition Default applies to a narrower class of cases than the Identity Function Default, the Function Composition Default overrides the Identity Function Default in determining a value for any portmanteau morpholexical function; thus, in the present instance, the Function Composition Default causes (38a) to be evaluated as (38b) rather than as (38c), as the Identity Function Default would otherwise require.

Nevertheless, given the existence of the morpholexical rule (30)*H*, the Maximal Subset Override causes (39a) to be evaluated as (39b) rather than as (39c), as the Function Composition Default would otherwise require.¹⁸

$$(38) \quad \text{Where } [\sigma] = \begin{bmatrix} \text{AGR}(\text{su}):[\text{PERS}:1, \text{NUM}:pl, \text{GEN}:m/wa], \text{TNS}:past, \text{POL}:neg, \\ \text{REL}(\mu):none, \text{AGR}(\text{ob}):none \end{bmatrix}$$

- a. $\text{MLF}_{(V \circ IV), [\sigma]}([_V \text{ ku } [_V \text{ taka}]])$
- b. $= \text{MLF}_{V, [\sigma]}(\text{MLF}_{IV, [\sigma]}([_V \text{ ku } [_V \text{ taka}]])$
- c. $\neq [_V \text{ ku } [_V \text{ taka}]])$

$$(39) \quad \text{Where } [\sigma] = \begin{bmatrix} \text{AGR}(\text{su}):[\text{PERS}:1, \text{NUM}:sg, \text{GEN}:m/wa], \text{TNS}:past, \text{POL}:neg, \\ \text{REL}(\mu):none, \text{AGR}(\text{ob}):none \end{bmatrix}$$

- a. $\text{MLF}_{(V \circ IV), [\sigma]}([_V \text{ ku } [_V \text{ taka}]])$
- b. $= \text{MLR}_{(V \circ IV), [\text{POL}:neg, \text{AGR}(\text{su}):[\text{PERS}:1, \text{NUM}:sg, \text{GEN}:m/wa], \text{REL}(\mu):none]}([_V \text{ ku } [_V \text{ taka}]])$
- c. $\neq \text{MLF}_{V, [\sigma]}(\text{MLF}_{IV, [\sigma]}([_V \text{ ku } [_V \text{ taka}]])$

Given these additional assumptions, it is possible to formulate a single paradigm function schema which correctly characterizes every one of the Swahili verb forms considered earlier, whether relative or non-relative, whether negative or positive, whether marked or unmarked for object concord; the definition of this paradigm function schema is given in (30)*I*.

The analysis proposed in (30) provides an optimal account of ambifixal, parallel, and portmanteau position classes in Swahili. The fundamental generalizations embodied in this analysis are the following three: (i) where an affix *x* belongs to a PORTMANTEAU position class whose members pre-empt slots *n* and *m*, the portmanteau morpholexical rule which spells out *x* competes with the composite of the two morpholexical functions MLF_m and MLF_n to determine the value of a portmanteau morpholexical function $\text{MLF}_{(n \circ m)}$; (ii) where two affixes *x*, *y* are members of an AMBIFIXAL position class associated with the (hierarchical) slot *n*, the morpholexical rules which spell out *x* and *y* participate in the definition of the same morpholexical function MLF_n ; and (iii) where an affix *x* appears as a member of each of two PARALLEL position classes *m* and *n*, the morpholexical rule which spells out *x* participates in the definition of both MLF_m and MLF_n . Consider each of these generalizations in greater detail, focussing first on the matter of portmanteau position classes.

As it is defined, the paradigm function schema (30)*I* correctly predicts that the first person singular negative prefix *si-* should pre-empt both the slot V occupied by the negative prefix *ha-* and the slot IV occupied by the first person singular subject prefix *ni-*. This is because the composite of the morpholexical function for slot IV with the one for slot V competes with the portmanteau rule of *si*-prefixation in (30)*H* to determine the value of the portmanteau morpholexical function $\text{MLF}_{(V \circ IV)}$. Consider, for example, the

forms *hatukutaka* 'we did not want' and *sikutaka* 'I did not want'. In the definition of *hatukutaka* in (40), there is no morpholexical rule which determines the value of $MLF_{(V \circ IV)}$ in accordance with the Maximal Subset Override; for this reason, the Function Composition Default causes $MLF_{(V \circ IV)}$ to be evaluated as the composite of MLF_{IV} with MLF_V . But in the definition of *sikutaka* in (41), the value of $MLF_{(V \circ IV)}$ is determined by the portmanteau morpholexical rule (30)*H* in accordance with the Maximal Subset Override; for this reason, $MLF_{(V \circ IV)}$ is in this instance evaluated as $MLR_{(V \circ IV), [POL: neg, AGR(su): [PERS: 1, NUM: sg, GEN: m/wa], REL(\mu): none]}$.

- (40) Where $[\sigma] = \left[\begin{array}{l} AGR(su): [PERS: 1, NUM: pl, GEN: m/wa], TNS: past, POL: neg, \\ REL(\mu): none, AGR(ob): none \end{array} \right]$
- $PF_{[\sigma]}([V \text{ taka}]) = MLF_{(V \circ IV), [\sigma]}(MLF_{III, [\sigma]}(MLF_{II, [\sigma]}(MLF_{I, [\sigma]}([V \text{ taka}])))$
 $= MLR_{V, [POL: neg, REL(\mu): none]}$
 applied to $MLR_{IV, [AGR(su): [PERS: 1, NUM: pl, GEN: m/wa]]}$
 applied to $MLR_{III, [POL: neg, TNS: past]}([V \text{ taka}])$
 $= [V \text{ ha } [V \text{ tu } [V \text{ ku } [V \text{ taka}]]]] \quad \text{'we didn't want'}$
- (41) Where $[\sigma] = \left[\begin{array}{l} AGR(su): [PERS: 1, NUM: sg, GEN: m/wa], TNS: past, POL: neg, \\ REL(\mu): none, AGR(ob): none \end{array} \right]$
- $PF_{[\sigma]}([V \text{ taka}]) = MLF_{(V \circ IV), [\sigma]}(MLF_{III, [\sigma]}(MLF_{II, [\sigma]}(MLF_{I, [\sigma]}([V \text{ taka}])))$
 $= MLR_{(V \circ IV), [POL: neg, AGR(su): [PERS: 1, NUM: sg, GEN: m/wa], REL(\mu): none]}$
 applied to $MLR_{III, [POL: neg, TNS: past]}([V \text{ taka}])$
 $= [V \text{ si } [V \text{ ku } [V \text{ taka}]]] \quad \text{'I didn't want'}$

Turn now to the problem of ambifixal position classes. As noted above, placing the Swahili relative prefixes together with their suffixal counterparts in a single, ambifixal position class has two desirable consequences: (i) it correctly predicts that the relative affixes are all mutually exclusive in their distribution; and (ii) it allows prefixal relatives and suffixal relatives to be viewed as alternative realizations of a single structural pattern. Both of these consequences follow directly from the paradigm function analysis in (30), in which the notion of an ambifixal position class is straightforwardly reconstructed as a class of prefixal and suffixal morpholexical rules which participate in the definition of one and the same morpholexical function. In this analysis, the rules which spell out the relative prefixes into slot II are as in (30)*B*. The rules which spell out relative suffixes are very similar to these prefixation rules — so similar that they can simply be omitted in favor of a single metarule by which they are directly predicted from the prefixation rules; thus, for any morpholexical rule which spells out a relative prefix into slot II, metarule (30)*F* determines a second morpholexical rule which spells out a relative suffix into the same hierarchical slot. Note that the feature content realized by the suffixation rules defined by (30)*F* is more narrowly specified than that realized by the corresponding prefixation rules in (30)*B*: unlike the relative prefixes, relative suffixes are defined as exponents of tense and polarity as well as of the feature $[REL(\mu)]$. For this reason, the Maximal

Subset Override guarantees that the relative affix will be spelled out suffixally in positive tenseless forms (as in (42)) but will otherwise be spelled out prefixally (as in (43)).

$$\begin{aligned}
 (42) \quad \text{Where } [\sigma] &= \begin{bmatrix} \text{AGR}(\text{su}):[\text{PERS:3, NUM:sg, GEN:m/wa}], \text{TNS:none, POL:pos,} \\ \text{REL}(\text{ob}):[\text{NUM:sg, GEN:ki/vi}], \text{AGR}(\text{ob}):[\text{PERS:3, NUM:sg, GEN:ki/vi}] \end{bmatrix} \\
 \text{PF}_{[\sigma]}([\text{v takal}]) &= \text{MLF}_{(\text{V} \circ \text{IV}), [\sigma]}(\text{MLF}_{\text{III}, [\sigma]}(\text{MLF}_{\text{II}, [\sigma]}(\text{MLF}_{\text{I}, [\sigma]}([\text{v takal}]))) \\
 &= \text{MLR}_{\text{IV}, [\text{AGR}(\text{su}):[\text{PERS:3, NUM:sg, GEN:m/wa}]]} \\
 &\quad \text{applied to MLR}_{\text{II}, [\text{TNS:none, POL:pos, REL}(\text{ob}):[\text{NUM:sg, GEN:ki/vi}]]} \\
 &\quad \text{applied to MLR}_{\text{I}, [\text{AGR}(\text{ob}):[\text{PERS:3, NUM:sg, GEN:ki/vi}]]}([\text{v takal}]) \\
 &= [\text{v a } [\text{v ki } [\text{v takal}]] \text{ chol}] \quad \text{'(book) which s/he wants'}
 \end{aligned}$$

$$\begin{aligned}
 (43) \quad \text{Where } [\sigma] &= \begin{bmatrix} \text{AGR}(\text{su}):[\text{PERS:3, NUM:sg, GEN:m/wa}], \text{TNS:definite, POL:pos,} \\ \text{REL}(\text{ob}):[\text{NUM:sg, GEN:ki/vi}], \text{AGR}(\text{ob}):[\text{PERS:3, NUM:sg, GEN:ki/vi}] \end{bmatrix} \\
 \text{PF}_{[\sigma]}([\text{v soma}]) &= \text{MLF}_{(\text{V} \circ \text{IV}), [\sigma]}(\text{MLF}_{\text{III}, [\sigma]}(\text{MLF}_{\text{II}, [\sigma]}(\text{MLF}_{\text{I}, [\sigma]}([\text{v soma}]))) \\
 &= \text{MLR}_{\text{IV}, [\text{AGR}(\text{su}):[\text{PERS:3, NUM:sg, GEN:m/wa}]]} \\
 &\quad \text{applied to MLR}_{\text{III}, [\text{TNS:definite}]} \\
 &\quad \text{applied to MLR}_{\text{II}, [\text{REL}(\text{ob}):[\text{NUM:sg, GEN:ki/vi}]]} \\
 &\quad \text{applied to MLR}_{\text{I}, [\text{AGR}(\text{ob}):[\text{PERS:3, NUM:sg, GEN:ki/vi}]]}([\text{v soma}]) \\
 &= [\text{v a } [\text{v na } [\text{v cho } [\text{v ki } [\text{v soma}]]]]] \quad \text{'(book) which s/he is reading'}
 \end{aligned}$$

This paradigm function analysis of Swahili relative verb forms is optimal in the two respects at issue here. First, because the same morphological function (MLF_{II}) introduces both prefixal and suffixal relative affixes, these are correctly predicted to be mutually exclusive; no extra stipulation is needed in order to block the occurrence of both a relative prefix and a relative suffix in the same verb form. Second, this analysis represents prefixal relatives (such as *anachokisoma*) and suffixal relatives (such as *akitakacho*) as instances of the same hierarchical pattern, as defined by the paradigm function schema $\text{PF}_{[\sigma]}$ in (30)*I*; that is, it provides a uniform account of the morphological organization of all relative verb forms. Indeed, it captures the fundamental structural similarities between relative and non-relative verb forms; note, for example, that non-relative verb forms such as those in Gleason's problem also exist as values of the paradigm function schema (30)*I*.¹⁹

Now consider the problem of parallel position classes. As noted earlier, many of the Swahili prefixes expressing object concord in slot I also express subject concord in slot IV. This generalization is captured in the proposed analysis by means of the morphological rules in (30)*G*: as they are stated, these rules participate in the definition of two distinct morphological functions (corresponding to two distinct slots). Thus, where g is the function $\{\langle \text{su}, \text{IV} \rangle, \langle \text{ob}, \text{I} \rangle\}$, the morphological rule $\text{MLR}_{g(\mu), [\text{AGR}(\mu):\alpha]}$ spells out a subject agreement inflection into slot IV and an object agreement inflection into slot I, participating in the definition of both MLF_{I} and MLF_{IV} ; the definition of *waliwapenda* 'they liked them' in (44) illustrates.

$$\begin{aligned}
 (44) \quad \text{Where } [\sigma] &= \left[\begin{array}{l} \text{AGR}(\text{su}):[\text{PERS:3, NUM:pl, GEN:m/wa}], \text{TNS:past, POL:pos,} \\ \text{REL}(\mu):\text{none, AGR}(\text{ob}):[\text{PERS:3, NUM:pl, GEN:m/wa}] \end{array} \right] \\
 \text{PF}_{[\sigma]}([\text{v penda}]) &= \text{MLF}_{(\text{V} \circ \text{IV}), [\sigma]}(\text{MLF}_{\text{III}, [\sigma]}(\text{MLF}_{\text{II}, [\sigma]}(\text{MLF}_{\text{I}, [\sigma]}([\text{v penda}])))) \\
 &= \text{MLR}_{\text{IV}, [\text{AGR}(\text{su}):[\text{PERS:3, NUM:pl, GEN:m/wa}]]} \\
 &\quad \text{applied to MLR}_{\text{III}, [\text{TNS:past}]} \\
 &\quad \text{applied to MLR}_{\text{I}, [\text{AGR}(\text{ob}):[\text{PERS:3, NUM:pl, GEN:m/wa}]]}([\text{v penda}]) \\
 &= [\text{v wa} [\text{v li} [\text{v wa} [\text{v penda}]]]] \quad \text{'they liked them'}
 \end{aligned}$$

Despite the ease with which the paradigm function approach accommodates ambifixal, parallel, and portmanteau position classes, neither the PS approaches nor the linear ordering approach affords a credible account of all three phenomena, as I now show.

6. TWO PROBLEMS FOR THE SUBCATEGORIZATION APPROACH: AMBIFIXAL AND PARALLEL POSITION CLASSES

Consider first the subcategorization approach and the problems which ambifixal position classes pose for it. Recall that in the paradigm function approach, the rules which specify whether an affix is prefixal or suffixal are distinct from those which specify how a word's inflectional affixes are hierarchically organized; it is this property which makes it possible for the paradigm function approach to accommodate the notion of an ambifixal position class so easily. In the subcategorization approach, however, an inflectional affix's subcategorization restriction has to determine both whether it is prefixal or suffixal and how that affix combines hierarchically with other inflectional affixes in the same word. This fact makes it impossible for the subcategorization approach to provide a straightforward account of ambifixal classes such as the Swahili relative affixes. Consider, for instance, the pair of relative verb forms *anachokisoma* '(book) which s/he is reading' and *akitakacho* '(book) which s/he wants' in (45). In order to generate these structures by means of a subcategorization account, one would have to assume that relative prefixes (such as *cho-* in (18a)) all carry the subcategorization restriction in (46a), and that the corresponding relative suffixes (such as *-cho* in (20a)) all carry the subcategorization restriction in (46b).

- (46) a. Subcategorization restriction on relative prefixes
 +[_____ V _____]
 $\left[\begin{array}{l} \text{AGR(su):unmarked} \\ \text{TNS:unmarked} \\ \text{POL:unmarked} \\ \text{REL}(\mu)\text{:unmarked} \\ \text{AGR(ob):marked} \end{array} \right]$
- b. Subcategorization restriction on relative suffixes
 +[_____ V _____]
 $\left[\begin{array}{l} \text{AGR(su):unmarked} \\ \text{TNS:unmarked} \\ \text{POL:unmarked} \\ \text{REL}(\mu)\text{:unmarked} \\ \text{AGR(ob):marked} \end{array} \right]$

This analysis would fail to capture two key generalizations about the class of relative affixes. First, the fact that relative prefixes and relative suffixes are mutually exclusive would not follow from any general principle in this analysis, but would instead just be treated as a consequence of the fact that the distribution of relative prefixes stipulated in (46a) and the distribution of relative suffixes stipulated in (46b) happen to be disjoint. Recall that in the paradigm function analysis proposed in (30), the mutual exclusiveness of relative prefixes and relative suffixes is predicted by the fact that they are introduced by a single morpholexical function as competitors for the same hierarchical slot; the choice between a relative prefix and the corresponding relative suffix is always simply determined by the Maximal Subset Override. In the subcategorization analysis in (46), by contrast, the mutual exclusiveness of relative prefixes and suffixes is portrayed as an accidental consequence of two independent stipulations; there is no general principle comparable to the Maximal Subset Override which always determines the choice between a relative prefix and the corresponding relative suffix.

A second, related defect of the subcategorization analysis sketched in (46) is that it fails to capture the fact that Swahili relative verb forms always instantiate the same principle of hierarchical organization. This principle is expressed as the paradigm function schema (30)*I* in the analysis proposed earlier; in (46), however, this same principle receives no direct expression but is instead treated as a coincidental result of the kinds of subcategorization restrictions assigned to the Swahili inflectional affixes. I conclude from these considerations that the subcategorization analysis in (46) is not optimal, and because its inadequacy stems directly from the nature of subcategorization restrictions (and not from some contingent detail of the analysis), the prospects seem no better for any imaginable variant of the subcategorization analysis.

Turn now to the problem of parallel position classes. Recall that in the paradigm function approach, parallel members of two distinct position classes can be spelled out by a single morpholexical rule participating in the definition of two distinct morpholexical functions; thus, rule (30)*G4* allows the third person plural agreement prefix *wa-* to realize both subject and object agreement. The subcategorization approach, by contrast, does not afford a simple account of parallel position classes. In this approach, parallel subject and object agreement prefixes would have to be assigned the distinct

subcategorization restrictions in (47). For instance, in order to account for both of its uses in (48), the prefix *wa-* would have to satisfy restriction (47a) when encoding subject agreement and restriction (47b) when encoding object agreement; a single, general distributional statement covering both instances of *wa-* would not obviously be feasible.

- (47) a. Subcategorization restriction on subject agreement prefixes
 +[$\begin{array}{c} \text{V} \\ \left[\begin{array}{l} \text{AGR}(\text{su}): \text{unmarked} \\ \text{TNS}: \text{marked} \\ \text{REL}(\mu): \text{marked} \\ \text{AGR}(\text{ob}): \text{marked} \end{array} \right] \end{array}]$
- b. Subcategorization restriction on object agreement prefixes
 +[$\begin{array}{c} \text{V} \\ \left[\begin{array}{l} \text{AGR}(\text{su}): \text{unmarked} \\ \text{TNS}: \text{unmarked} \\ \text{POL}: \text{unmarked} \\ \text{REL}(\mu): \text{unmarked} \\ \text{AGR}(\text{ob}): \text{unmarked} \end{array} \right] \end{array}]$

7. TWO PROBLEMS FOR THE PURE PS APPROACH: AMBIFIXAL AND PORTMANTEAU POSITION CLASSES

Like the subcategorization approach to position classes and unlike the paradigm function approach, the pure PS approach requires rules of a single sort to determine both whether an inflectional affix is prefixal or suffixal and how that affix combines hierarchically with other inflectional affixes in the same word: in this case, both properties are determined by the rewrite rules

which generate affixal nodes. For this reason, the pure PS approach does not afford an adequate account of ambifixal classes such as the Swahili relative affixes.

Consider, for concreteness, the pure PS analysis of Swahili relative verb forms in (49). In this analysis, four rewrite rules are necessary: (49a) and (49b) generate prefixal relative verb forms, with or without an object agreement prefix; (49c) and (49d) generate suffixal relative verb forms, again with or without object agreement. Unlike the subcategorization analysis (46) and the paradigm function analysis (30), the pure PS analysis in (49) treats relative suffixes as having exactly the same feature content as the corresponding relative prefixes; that is, it allows the suffixes to be IDENTIFIED WITH the prefixes, thereby avoiding the need for any rule like the morpholexical metarule (30)*F*.

(49) Rewrite rules for a pure PS analysis of Swahili relative verb forms

$$\begin{array}{c} \text{a.} \quad \begin{array}{c} \text{V} \\ \left[\begin{array}{l} \text{AGR}(\text{su}): \alpha \\ \text{TNS}: \beta \\ \text{POL}: \gamma \\ \text{REL}(\mu): \delta \\ \text{AGR}(\text{ob}): \varepsilon \end{array} \right] \end{array} \rightarrow \begin{array}{c} \text{Af} \quad \text{Af} \quad \text{Af} \quad \text{Af} \quad \text{V} \\ \left[\text{AGR}(\text{su}): \alpha \right] \left[\text{TNS}: \beta, (\text{POL}: \gamma) \right] \left[\text{REL}(\mu): \delta \right] \left[\text{AGR}(\text{ob}): \varepsilon \right] \end{array} \end{array}$$

$$\begin{array}{c} \text{b.} \quad \begin{array}{c} \text{V} \\ \left[\begin{array}{l} \text{AGR}(\text{su}): \alpha \\ \text{TNS}: \beta \\ \text{POL}: \gamma \\ \text{REL}(\mu): \delta \\ \text{AGR}(\text{ob}): \text{none} \end{array} \right] \end{array} \rightarrow \begin{array}{c} \text{Af} \quad \text{Af} \quad \text{Af} \quad \text{V} \\ \left[\text{AGR}(\text{su}): \alpha \right] \left[\text{TNS}: \beta, (\text{POL}: \gamma) \right] \left[\text{REL}(\mu): \delta \right] \end{array} \end{array}$$

$$\begin{array}{c} \text{c.} \quad \begin{array}{c} \text{V} \\ \left[\begin{array}{l} \text{AGR}(\text{su}): \alpha \\ \text{TNS}: \text{none} \\ \text{POL}: \text{pos} \\ \text{REL}(\mu): \beta \\ \text{AGR}(\text{ob}): \gamma \end{array} \right] \end{array} \rightarrow \begin{array}{c} \text{Af} \quad \text{Af} \quad \text{V} \quad \text{Af} \\ \left[\text{AGR}(\text{su}): \alpha \right] \left[\text{AGR}(\text{ob}): \gamma \right] \left[\text{REL}(\mu): \beta \right] \end{array} \end{array}$$

$$\begin{array}{c} \text{d.} \quad \begin{array}{c} \text{V} \\ \left[\begin{array}{l} \text{AGR}(\text{su}): \alpha \\ \text{TNS}: \text{none} \\ \text{POL}: \text{pos} \\ \text{REL}(\mu): \beta \\ \text{AGR}(\text{ob}): \text{none} \end{array} \right] \end{array} \rightarrow \begin{array}{c} \text{Af} \quad \text{V} \quad \text{Af} \\ \left[\text{AGR}(\text{su}): \alpha \right] \left[\text{REL}(\mu): \beta \right] \end{array} \end{array}$$

In the pure PS analysis in (49), the prefixal relative verb form *anachokisoma* '(book) which s/he is reading' is assigned the structure in (50a), and the suffixal relative verb form *akitakacho* '(book) which s/he wants' is assigned the structure in (50b).

- (50) Where: α = [PERS:3, NUM:sg, GEN:m/wa]
 β = [NUM:sg, GEN:ki/vi]
 γ = [PERS:3, NUM:sg, GEN:ki/vi]

The structures in (50) are completely plausible, provided that one is willing to accept the (debatable) claim that a word's layer of inflectional morphology has a flat structure rather than a layered structure (as in (42), (43), and (45)). (For discussion of this question, see Churma (1987), Lounsbury (1957), Scalise (1988), Thomas-Flinders (1983), and Zwicky (1987).) As in the case of the subcategorization analysis, the principal objection to the analysis in (49) is that it fails to represent relative affixes as constituting a single ambifixal position class. Here again, the mutual exclusiveness of relative prefixes and suffixes is portrayed as an accidental consequence of independent stipulations — four of them, in this case: the rewrite rules (49a, b) which generate relative prefixes happen not to generate relative suffixes, and the rules (49c, d) which generate relative suffixes happen not to generate relative prefixes; there is no general principle comparable to the Maximal Subset Override which uniformly determines the choice between a relative

prefix and its suffixal counterpart. Moreover, the pure PS analysis fails to represent prefixal relative verb forms as having any systematic structural similarity to suffixal relative verb forms, requiring separate rewrite rules for each type of structure. The rewrite rules in (49) are, in fact, massively redundant; they stipulate many of the same ordering relations among affixes (and between affixes and the verb root) over and over again. I conclude from these facts that rewrite rules are as inherently unsuitable as subcategorization restrictions for capturing the notion of an ambifixal position class.

Before abandoning the pure PS approach to ambifixal position classes, one might attempt to duplicate the properties of the paradigm function analysis by adopting a format for rewrite rules in which the hierarchical organization of constituents and their linear ordering are stated separately. The most clearly developed format of this type is the ID/LP format advocated by Gazdar, Klein, Pullum, and Sag (1985). They argue for an approach to phrase structure in which classical context-free phrase structure rules are dispensed with in favor of rules of two types: ID rules which specify IMMEDIATE DOMINANCE relations among constituents and LP rules which specify LINEAR PRECEDENCE relations between sister constituents. This rule format makes it possible to eliminate a good deal of redundancy in descriptions of phrase structure. Consider, for example, the classical context-free rewrite rules in (51): these are redundant to the extent that they state and restate the generalization in (52) four times. This redundancy can be eliminated by employing the ID/LP format, as in (53): the ID rules in (53a) specify immediate dominance relations without referring to the linear ordering of constituents, while the LP rules in (53b) specify linear ordering relations which remain valid from one construction to the next; note, in particular, that generalization (52) is captured by a single LP rule.

- (51) $V^1 \rightarrow V^0 N^2 P^2$ (e.g. *put the book on the shelf*)
 $N^1 \rightarrow N^1 P^2$ (e.g. *student from France*)
 $N^1 \rightarrow N^0 P^2$ (e.g. *student of physics*)
 $A^1 \rightarrow A^0 P^2$ (e.g. *happy about the news*)

- (52) A prepositional phrase always follows a nominal or adjectival sister (i.e. a sister which is [+N]).

- (53) a. ID rules: $V^1 \rightarrow V^0, N^2, P^2$ b. LP rules: $V^0 < N^2$
 $N^1 \rightarrow N^1, P^2$ $[+N]^n < P^2$
 $N^1 \rightarrow N^0, P^2$ (cf. Gazdar *et al.* 1985:
 $A^1 \rightarrow A^0, P^2$ 129)

Because the ID/LP approach to rewrite rules describes hierarchical structure separately from linear ordering, one might expect that it would afford as simple an analysis of ambifixal position classes as the paradigm function approach. For instance, one might entertain the ID/LP analysis of Swahili relative verb forms in (54).

(54) An ID/LP analysis of Swahili relative verb forms

- a. ID rule: $V \rightarrow Af_{[AGR(su):\alpha]} (Af_{[TNS:\beta, (POL:\gamma)]} Af_{[REL(\mu):\delta]} (Af_{[AGR(ob):\varepsilon]}) V^{root}$
- b. LP rules: $Af_{[AGR(su):\alpha]} < Af_{[TNS:\beta, (POL:\gamma)]} < Af_{[REL(\mu):\delta]} < (Af_{[AGR(ob):\varepsilon]}) < V^{root}$
 $Af_{[AGR(su):\alpha]} < (Af_{[AGR(ob):\varepsilon]}) < V^{root} < Af_{[REL(\mu):\delta]}$

On first consideration, (54) seems like a credible analysis. Note, first, that the ID rule in (54a) does correctly predict the mutual exclusiveness of relative prefixes and relative suffixes, all of which are instances of the same node ($Af_{[REL(\mu):\delta]}$) in this rule. In addition, this analysis treats prefixal relative verb forms (such as *anachokisoma*) and suffixal relative verb forms (such as *akitakacho*) as instantiating the same hierarchical pattern, as defined by the ID rule (54a).

Notwithstanding these desirable characteristics, there are clear defects with this analysis. The LP rules in (54b) are not strictly analogous to those in (53b). In syntax, LP rules are used to state ordering generalizations which are invariant from one construction to another; for instance, the rule $[+N]^n < P^2$ holds true in each of the constructions in (53a) and indeed throughout English syntax (if one abstracts away from the effects of heavy constituent shift). But the very point that is at issue in the Swahili data is that there is no single, invariant ordering of V^{root} and $Af_{[REL(\mu):\delta]}$ (nor of $Af_{[AGR(ob):\varepsilon]}$ and $Af_{[REL(\mu):\delta]}$); the LP rules in (54b) prescribe different orderings of V^{root} and $Af_{[REL(\mu):\delta]}$ (and of $Af_{[AGR(ob):\varepsilon]}$ and $Af_{[REL(\mu):\delta]}$) in different contexts. Thus, while LP rules in syntax describe dyadic ordering relations, those in (54b) are necessarily polyadic: unlike the linear ordering of $[+N]^n$ and P^2 , the ordering of V^{root} and $Af_{[REL(\mu):\delta]}$ (and that of $Af_{[AGR(ob):\varepsilon]}$ and $Af_{[REL(\mu):\delta]}$) cannot be stated once and for all but must instead be made sensitive to the presence or absence of a third constituent (namely $Af_{[TNS:\beta, (POL:\gamma)]}$). Given this fact, the analysis in (54) does not, strictly speaking, conform to the ID/LP format, since it does not possess the property of exhaustive constant partial ordering discussed by Gazdar *et al.* (1985: 49); moreover, the LP rules in (54b) are massively redundant, insofar as they both stipulate exactly the same ordering for each of the following pairs: $Af_{[AGR(su):\alpha]}$ and $Af_{[REL(\mu):\delta]}$, $Af_{[AGR(su):\alpha]}$ and $Af_{[AGR(ob):\varepsilon]}$, $Af_{[AGR(su):\alpha]}$ and V^{root} , and $Af_{[AGR(ob):\varepsilon]}$ and V^{root} . These facts reveal the unsuitability of the ID/LP format for capturing the notion of an ambifixal position class;²⁰ more broadly, they cast serious doubts on the analogy alleged to hold between rules of morphology and rules of syntax.

Besides failing to provide an adequate account of ambifixal position classes, the pure PS approach to affix ordering cannot capture the notion of a portmanteau position class. In this sort of approach, the fact that the Swahili first person singular negative prefix *si-* pre-empts both the slot V occupied by the *ha-* class and the slot IV occupied by the subject agreement class would seemingly require the postulation of separate PS rules for *si-* negatives (e.g. *sikutaka* 'I didn't want') and *ha-* negatives (e.g. *hatukutaka* 'we didn't want'), as in (55). These rules, however, are massively redundant; unlike the

paradigm function schema (30)I, they fail to capture the fundamental structural similarity of all negative verb forms in Swahili.

- (55) a. PS rule for *si-* negatives: Where $\alpha = [\text{PERS:1, NUM:sg, GEN:m/wa}]$,

$$\begin{array}{c} \text{V} \\ \left[\begin{array}{l} \text{AGR(su):}\alpha \\ \text{TNS:}\beta \\ \text{POL:neg} \end{array} \right] \end{array} \rightarrow \begin{array}{c} \text{Af} \\ \left[\begin{array}{l} \text{AGR(su):}\alpha \\ \text{POL:neg} \end{array} \right] \end{array} \quad \begin{array}{c} \text{Af} \\ \text{[TNS:}\beta\text{]} \end{array} \quad \begin{array}{c} \text{V} \end{array}$$

- b. PS rule for *ha-* negatives: Where α is other than as in (55a),

$$\begin{array}{c} \text{V} \\ \left[\begin{array}{l} \text{AGR(su):}\alpha \\ \text{TNS:}\beta \\ \text{POL:neg} \end{array} \right] \end{array} \rightarrow \begin{array}{c} \text{Af} \\ \text{[POL:neg]} \end{array} \quad \begin{array}{c} \text{Af} \\ \text{[AGR(su):}\alpha\text{]} \end{array} \quad \begin{array}{c} \text{Af} \\ \text{[TNS:}\beta\text{]} \end{array} \quad \begin{array}{c} \text{V} \end{array}$$

8. TWO PROBLEMS FOR THE LINEAR ORDERING APPROACH: PARALLEL AND PORTMANTEAU POSITION CLASSES

On first consideration, one might suppose that the paradigm function analysis in (30) is simply a notational variant of a linear ordering analysis of the kind proposed earlier for Gleason's problem. Careful scrutiny, however, reveals that the paradigm function approach provides a superior account of parallel and portmanteau position classes. To see this, consider the linear ordering analysis in (56); to the extent possible, this is modelled after the paradigm function analysis in (30).

- (56) A linear ordering analysis of Swahili verb forms (partial)

	OPERATION	REALIZES
a. Rule block I:		
i.	<i>ni</i> -prefixation	[AGR(ob):[PERS:1, NUM:sg, GEN:m/wa]]
ii.	<i>ku</i> -prefixation	[AGR(ob):[PERS:2, NUM:sg, GEN:m/wa]]
iii.	<i>m</i> -prefixation	[AGR(ob):[PERS:3, NUM:sg, GEN:m/wa]]
iv.	<i>ki</i> -prefixation	[AGR(ob):[PERS:3, NUM:sg, GEN:ki/vi]]
v.	<i>tu</i> -prefixation	[AGR(ob):[PERS:1, NUM:pl, GEN:m/wa]]
vi.	<i>wa</i> -prefixation	[AGR(ob):[PERS:2, NUM:pl, GEN:m/wa]]
vii.	<i>wa</i> -prefixation	[AGR(ob):[PERS:3, NUM:pl, GEN:m/wa]]
viii.	<i>vi</i> -prefixation	[AGR(ob):[PERS:3, NUM:pl, GEN:ki/vi]]
b. Rule block II:		
	<i>ye</i> -prefixation	[REL(μ):[NUM:sg, GEN:m/wa]]
	<i>cho</i> -prefixation	[REL(μ):[NUM:sg, GEN:ki/vi]]
	<i>o</i> -prefixation	[REL(μ):[NUM:pl, GEN:m/wa]]
	<i>vyo</i> -prefixation	[REL(μ):[NUM:pl, GEN:ki/vi]]
	<i>ye</i> -suffixation	[TNS:none, POL:pos, REL(μ):[NUM:sg, GEN:m/wa]]
	<i>cho</i> -suffixation	[TNS:none, POL:pos, REL(μ):[NUM:sg, GEN:ki/vi]]
	<i>o</i> -suffixation	[TNS:none, POL:pos, REL(μ):[NUM:pl, GEN:m/wa]]
	<i>vyo</i> -suffixation	[TNS:none, POL:pos, REL(μ):[NUM:pl, GEN:ki/vi]]

- c. Rule block III:
<i>na</i> -prefixation	[TNS:definite]
<i>ta</i> -prefixation	[TNS:future]
<i>taka</i> -prefixation	[TNS:future, REL(μ):[NUM: α , GEN: β]]
<i>li</i> -prefixation	[TNS:past]
<i>ku</i> -prefixation	[POL:neg, TNS:past]
<i>si</i> -prefixation	[POL:neg, REL(μ):[NUM: α , GEN: β]]
- d. Rule block IV:
i. <i>ni</i> -prefixation	[AGR(su):[PERS:1, NUM:sg, GEN:m/wa]]
ii. <i>u</i> -prefixation	[AGR(su):[PERS:2, NUM:sg, GEN:m/wa]]
iii. <i>a</i> -prefixation	[AGR(su):[PERS:3, NUM:sg, GEN:m/wa]]
iv. <i>ki</i> -prefixation	[AGR(su):[PERS:3, NUM:sg, GEN:ki/vi]]
v. <i>tu</i> -prefixation	[AGR(su):[PERS:1, NUM:pl, GEN:m/wa]]
vi. <i>m</i> -prefixation	[AGR(su):[PERS:2, NUM:pl, GEN:m/wa]]
vii. <i>wa</i> -prefixation	[AGR(su):[PERS:3, NUM:pl, GEN:m/wa]]
viii. <i>vi</i> -prefixation	[AGR(su):[PERS:3, NUM:pl, GEN:ki/vi]]
- e. Rule block V: *ha*-prefixation [POL:neg, REL(μ):none]
- f. *si*-prefixation $\left[\begin{array}{l} \text{AGR(su):[PERS:1, NUM:sg, GEN:m/wa],} \\ \text{POL:neg, REL(\mu):none} \end{array} \right]$
- g. Linear ordering of rule blocks: I: II: III: IV: V

Recall that in the paradigm function analysis (30), the phenomenon of parallel position classes is accounted for by allowing certain morpholexical rules to participate in the definition of more than one morpholexical function. The linear ordering approach, however, does not afford an analogous simplification. In the linear ordering analysis in (56), the block of subject agreement rules in (56d) must be distinct from the block of object agreement rules in (56a) because the two blocks differ in their linear ordering; for instance, in the formation of *wa-li-wa-penda* 'they liked them' in (57), the object agreement rule of *wa*-prefixation (56a/vii) must precede the subject agreement rule of *wa*-prefixation (56d/vii). No similar complication can arise in the paradigm function approach: because the ordering of position classes is stipulated not in terms of morpholexical rules but in terms of morpholexical functions, the morpholexical rules are themselves inherently unordered, functioning simply as clauses in the definitions of morpholexical functions.

$$(57) \text{ a. } \left\langle \begin{array}{l} \text{AGR(su):[PERS:3, NUM:pl, GEN:m/wa]} \\ \text{TNS:past} \\ \text{POL:pos} \\ \text{REL(\mu):none} \\ \text{AGR(ob):[PERS:3, NUM:pl, GEN:m/wa]} \end{array} \right\rangle, -penda \rangle$$

- b. Verb root: *-penda*
 Rule block I: *wa-penda*
 Rule block III: *li-wa-penda*
 Rule block IV: *wa-li-wa-penda* 'they liked them'

A proponent of the linear ordering approach might, of course, propose to

eliminate the redundancy in (56) by devising a metarule which predicted realization rules in block IV from their counterparts in block I, but this move would not actually afford any reduction in the number of realization rules needed to generate Swahili verb forms, nor does the paradigm function analysis require anything comparable to such a metarule to account for the same facts.

The phenomenon of portmanteau position classes highlights a second clear difference between the paradigm function approach and the linear ordering approach. To see this, consider what sort of status might be accorded to the rule (56f) of *si*-prefixation. Should this simply be incorporated into one of the existing rule blocks in (56d, e)? Or does it constitute a separate block? If so, how does this additional block fit into the system of rule interactions defined in (56g)?

Complications arise if the rule of *si*-prefixation is simply incorporated into Block IV or Block V. If it were added to Block IV in (56d), nothing would exclude the successive prefixation of *si*- and *ha*- to produce forms such as **hasikutaka* 'I did not want'. (Following Anderson (1986), one might attempt to argue that the Elsewhere Condition prevents the application of *ha*- prefixation once *si*-prefixation has already applied since the latter operation only applies to a proper subset of the forms to which the former is applicable; this line of reasoning cannot be maintained, however, since it entails — erroneously — that in the formation of negative past tense verb forms, the application of *ku*-prefixation should likewise exclude the subsequent application of *ha*-prefixation.) On the other hand, if *si*-prefixation were added to Block V in (56e), nothing would exclude the successive prefixation of *ni*- and *si*- to produce forms such as **sinikutaka* 'I did not want'. The only way in which one could assign *si*-prefixation to Block IV or to Block V would be to narrow the range of forms to which *ha*-prefixation or *ni*-prefixation would apply. For instance, if *ha*-prefixation were assumed to be an exponent of non-[PERS:1, NUM:sg, GEN:m/wa] subject concord as well as of the feature specifications [POL:neg, REL(μ):none], then **hasikutaka* would be correctly predicted not to occur even if *si*-prefixation were assigned to Block IV; similarly, if *ni*-prefixation were assumed to be an exponent of [POL:pos] as well as of [AGR(su):[PERS:1, NUM:sg, GEN:m/wa]], then **sinikutaka* would be correctly predicted not to occur even if *si*-prefixation were assigned to Block V. Neither of these two solutions is attractive: by complicating the set of feature specifications associated with *ha*- or with *ni*-, they relinquish the generalization that *ha*-prefixation and *ni*-prefixation are defaults which are overridden by *si*-prefixation. (This same generalization, however, is plainly expressed in the paradigm function analysis in (30).)

As an alternative to complicating the rule of *ha*-prefixation or *ni*-prefixation, one might instead abandon the simple ordering in (56g) in favor of a more complicated system of rule interactions. For instance, one could assume that *si*-prefixation itself constitutes a separate rule block VI which is

disjunctively ordered with respect to blocks IV and V; that is, one might assume that the rules in (56) interact as in (58).

- (58) a. Linear ordering of rule blocks: III : VI and III : IV : V
 b. Disjunctive ordering of rule blocks: VI and {IV, V} are mutually exclusive

A framework which allows the disjunctive ordering of rule BLOCKS is significantly less restrictive than one in which disjunctive ordering is only a property of individual rules within the same block (that is, in which the ordering relations between rule blocks are always purely linear); moreover, it is inherently less restrictive than a paradigm function framework incorporating portmanteau morpholexical rules and the Function Composition Default.

To see this, consider the following pair of schematic systems of rule interaction within the linear ordering framework:

- (59) a. i. Linear ordering of rule blocks: A : B and A : C : D
 ii. Disjunctive ordering of rule blocks: B and {C, D} are mutually exclusive
 b. i. Linear ordering of rule blocks: A : C : D and B : C
 ii. Disjunctive ordering of rule blocks: B and {A, D} are mutually exclusive

System (59a) is instantiated by (58). System (59b) is neither more nor less complicated than (59a): both include the same number of rule blocks and the same number of linear and disjunctive ordering stipulations. Nothing in the linear ordering framework would necessarily lead one to expect one or the other system to be more likely to occur in a language. Intuitively, however, B is less plausible as a portmanteau position class in (59b) than in (59a), since ordinarily (perhaps always?), the position classes supplanted by a portmanteau position class are hierarchically adjacent to one another (like C and D in (59a)) rather than discontinuous (like A and D in (59b)). It is not obvious that this generalization can be captured nonstipulatively in the linear ordering approach. In the paradigm function approach, on the other hand, this generalization follows from the Function Composition Default, according to which any portmanteau morpholexical function $MLF_{(m \circ n)}$ has as its default value the composite of MLF_n with MLF_m ; by the definition of function composition, the successive application of MLF_n and MLF_m cannot be interrupted by the application of some extraneous morpholexical function in determining this default value for $MLF_{(m \circ n)}$.

9. REVERSIBLE POSITION CLASSES

Before concluding, I wish to draw attention to a fourth position class phenomenon and the additional support which it provides for the paradigm

function approach to morphology. This fourth phenomenon, exhibited by certain pairs of position classes, is that of REVERSIBILITY: members of position class A precede those of position class B in one set of forms, while members of class B precede those of class A in a complementary set of forms. This phenomenon (sometimes referred to as 'morph(eme) metathesis') is not particularly rare; cf. the Quechua cases alluded to by Muysken (1986: 635) and the Swazi examples cited by Zwicky (1992: 353). Fula provides a clear example of reversible position classes.

Fula verbs inflect for both subject and object agreement;²¹ for concreteness, consider the relative past tense forms in (60) (from Arnott (1970, Appendix 15)).

(60) Some relative past tense active forms of Fula *wall-* 'help'

a.	'o-wall-i- <i>be</i> '
<i>he:CL.1-help-REL:PAST:ACT-them:CL.2</i>
'he helped them'	'o-wall-u-noo- <i>be</i> '
<i>he:CL.1-help-REL:PAST:ACT-PRET-them:CL.2</i>
'he had helped them'	
b.	'o-wall-i-mo'
<i>he:CL.1-help-REL:PAST:ACT-him:CL.1</i>
'he helped him'	'o-wall-u-noo-mo'
<i>he:CL.1-help-REL:PAST:ACT-PRET-him:CL.1</i>
'he had helped him'	
c.	'o-wall-u-(no)-maa'
<i>he:CL.1-help-REL:PAST:ACT-(PRET)-you:SG</i>
'he (had) helped you (sg.)'	d.	mball-u-(no)- <i>daa-be</i> '
<i>help-REL:PAST:ACT-(PRET)-you:SG-them:CL.2</i>
'you (sg.) (had) helped them'
e.	mball-u-(no)- <i>daa-mo</i> '
<i>help-REL:PAST:ACT-(PRET)-you:SG-him:CL.1</i>
'you (sg.) (had) helped him'	f.	mball-u-(noo)- <i>don-be</i> '
<i>help-REL:PAST:ACT-(PRET)-you:PL-them:CL.2</i>
'you (pl.) (had) helped them'
g.	mball-u-(noo)- <i>don-mo</i> '
<i>help-REL:PAST:ACT-(PRET)-you:PL-him:CL.1</i>
'you (pl.) (had) helped him'	h.	mball-u-(noo)-mi- <i>be</i> '
<i>help-REL:PAST:ACT-(PRET)-I-them:CL.2</i>
'I (had) helped them'
i.	mball-u-(no)-moo-mi'
<i>help-REL:PAST:ACT-(PRET)-him:CL.1-I</i>
'I (had) helped him'	j.	mball-u-(no)-maa-mi'
<i>help-REL:PAST:ACT-(PRET)-you:SG-I</i>
'I (had) helped you (sg.)'

In relative past tense forms such as these, the subject agreement inflections are partly prefixal and partly suffixal, as noted earlier in (25); the object agreement inflections, on the other hand, are uniformly suffixal, as in (61).

(61) Personal object agreement suffixes in Fula (relative past tense)²²

PERSON	SINGULAR	PLURAL
1	-yam	-min
2	-maa	INCLUSIVE: -'en EXCLUSIVE: -'on
3	CLASS 1: -mo(o)	CLASS 2: -be

In most of the forms in (60), the object agreement suffix follows the subject agreement affix, whether this is prefixal (as in (60a—c)) or suffixal (as in (60d—h)); this fact is consistent with the assumption that the object agreement suffixes in (61) constitute a position class which is hierarchically 'outside of' the position class containing the subject agreement affixes in (25).

There are, however, exactly two situations in which the object agreement suffix PRECEDES (and is hence hierarchically 'inside of') the subject agreement affix in a relative past tense form, namely when the first person singular subject agreement suffix *-mi* cooccurs with either the second person singular object agreement suffix *-maa* or the third person singular (class 1) object agreement suffix *-mo(o)*, as in (60i, j). Nevertheless, when *-mi* appears with any other sort of object agreement suffix (as in (60h)), it is distributionally indistinguishable from the other subject agreement affixes in (25); similarly, when *-maa* and *-mo(o)* appear with any other sort of subject agreement affix (as in (60b, c, e, g)), they are distributionally parallel to the other object agreement affixes in (61).

In order to come to grips with cases such as these, Zwicky (1989: 226) proposes that the slots associated with a set of position classes may vary in their sequence from one class of inflected forms to another. On this view, the preterite form *mball-u-noo-mi-be* 'I had helped them' (= (60h)) would instantiate the sequence of position classes in (62a), while the expression *mball-u-no-moo-mi* 'I had helped him' (= (60i)) would instantiate the alternative sequence in (62b).

(62) Alternative sequences of suffix position classes in Fula relative past tense verb forms

a. Position class:	I	II	III	IV
Features encoded:	[TNS, VCE]	[PRET]	[AGR(su)]	[AGR(ob)]
b. Position class:	I	II	IV	III
Features encoded:	[TNS, VCE]	[PRET]	[AGR(ob)]	[AGR(su)]

10. ACCOUNTING FOR REVERSIBLE POSITION CLASSES IN THE PARADIGM FUNCTION APPROACH

This idea is easily implemented within the paradigm function approach to position classes. For the purposes of the analysis which I shall propose, I assume that Fula verb forms carry specifications for five features and that the permissible values for these features are as in (63).²³

(63) Permissible values for features

FEATURE	PERMISSIBLE VALUES
[AGR(su)]	'1sg', '2sg', '3sg/class1', '1pl', '2pl/incl', '2pl/excl', '3pl/class2'
[TNS]	'relative past'
[VCE]	'active', 'middle', 'passive'
[PRET]	'yes', 'no'
[AGR(ob)]	'1sg', '2sg', '3sg/class1', '1pl', '2pl/incl', '2pl/excl', '3pl/class2'

Consider now the analysis proposed in (64). The four sets of morphological rules in (64a–d) correspond to the four position classes represented in (62). Those in (64a) spell out suffixes encoding tense and voice into slot I: *-aa* in the relative past passive, *-ii* in the relative past middle, and *-i* or *-U* in the relative past active (depending on the person and number of the verb's subject). The rule (64b) spells out the preterite suffix *-noo* (alluded to above in Section 2) into slot II. The rules in (64c, d) spell out the affixes expressing subject and object agreement into the (hierarchical) slots III and IV, respectively.²⁴

(64) A paradigm function analysis of Fula relative past tense verb forms (partial)

a. *Morphological rules for slot I*

$MLR_{I,[AGR(su):\alpha, TNS:relative\ past, VCE:active]}([v\ x]) =_{def} [v\ [v\ x]\ i],$
where $\alpha = 3sg/pl\ or\ 1pl$

$MLR_{I,[TNS:relative\ past, VCE:active]}([v\ x]) =_{def} [v\ [v\ x]\ U]$

$MLR_{I,[TNS:relative\ past, VCE:middle]}([v\ x]) =_{def} [v\ [v\ x]\ ii]$

$MLR_{I,[TNS:relative\ past, VCE:passive]}([v\ x]) =_{def} [v\ [v\ x]\ aa]$

b. *Morphological rule for slot II*

$MLR_{II,[PRET:yes]}([v\ x]) =_{def} [v\ [v\ x]\ noo]$

c. *Morphological rules for slot III*

$MLR_{III,[AGR(su):1sg]}([v\ x]) =_{def} [v\ [v\ x]\ mi]$

$MLR_{III,[AGR(su):2sg]}([v\ x]) =_{def} [v\ [v\ x]\ daa]$

$MLR_{III,[AGR(su):3sg/class1]}([v\ x]) =_{def} [v\ 'o\ [v\ x]]$

$MLR_{III,[AGR(su):1pl]}([v\ x]) =_{def} [v\ min\ [v\ x]]$

$MLR_{III,[AGR(su):2pl/incl]}([v\ x]) =_{def} [v\ [v\ x]\ den]$

$MLR_{III,[AGR(su):2pl/excl]}([v\ x]) =_{def} [v\ [v\ x]\ don]$

$MLR_{III,[AGR(su):3pl/class2]}([v\ x]) =_{def} [v\ be\ [v\ x]]$

d. *Morphological rules for slot IV*

$MLR_{IV,[AGR(ob):1sg]}([v\ x]) =_{def} [v\ [v\ x]\ yam]$

$MLR_{IV,[AGR(ob):2sg]}([v\ x]) =_{def} [v\ [v\ x]\ maa]$

$MLR_{IV,[AGR(ob):3sg/class1]}([v\ x]) =_{def} [v\ [v\ x]\ mo]$

$MLR_{IV,[AGR(ob):1pl]}([v\ x]) =_{def} [v\ [v\ x]\ min]$

$MLR_{IV,[AGR(ob):2pl/incl]}([v\ x]) =_{def} [v\ [v\ x]\ 'en]$

$MLR_{IV,[AGR(ob):2pl/excl]}([v\ x]) =_{def} [v\ [v\ x]\ 'on]$

$MLR_{IV,[AGR(ob):3pl/class2]}([v\ x]) =_{def} [v\ [v\ x]\ be]$

e. *Paradigm function schema for Fula verbal inflection*

i. Default:

Where $[\sigma] = [AGR(su):\alpha, TNS:\beta, VCE:\gamma, PRET:\delta,$
 $AGR(ob):\varepsilon],$

$PF_{[\sigma]}([v\ x]) =_{def} MLF_{(IV \circ (III \circ (II \circ I))), [\sigma]}([v\ x])$

ii. But:

Where $[\sigma] = [\text{AGR}(\text{su}):1\text{sg}, \text{TNS}:\text{relative past}, \text{VCE}:\alpha, \text{PRET}:\beta, \text{AGR}(\text{ob}):\gamma]$ and $\gamma = 2\text{sg}$ or $3\text{sg}/\text{class1}$, $\text{PF}_{[\sigma]}([v\ x])$
 $=_{\text{def}} \text{MLF}_{(\text{III} \circ (\text{IV} \circ (\text{II} \circ \text{I}))), [\sigma]}([v\ x])$

The four sets of morpholexical rules in (64a–d) determine four morpholexical functions MLF_I , MLF_{II} , MLF_{III} , and MLF_{IV} corresponding to the four hierarchical slots in (62); it is in terms of these morpholexical functions that the paradigm function schema in (64e) is stated. According to the default clause in (64e/i), the usual sequence in which the four morpholexical functions apply in relative past tense forms is as in (62a). In accordance with this default clause, the form *mball-u-noo-mi-be* ‘I had helped them’ in (60h) is identified as the relative past active preterite form of *wall-* ‘help’ with first person singular subject agreement and third person plural (class 2) object agreement:

$$\begin{aligned}
 (65) \quad \text{Where } [\sigma] &= \left[\begin{array}{l} \text{AGR}(\text{su}):1\text{sg}, \text{TNS}:\text{relative past}, \text{VCE}:\text{active}, \text{PRET}:\text{yes}, \\ \text{AGR}(\text{ob}):3\text{pl}/\text{class2} \end{array} \right] \\
 \text{PF}_{[\sigma]}([v\ \text{wall}]) &= \text{MLF}_{(\text{IV} \circ (\text{III} \circ (\text{II} \circ \text{I}))), [\sigma]}([v\ \text{wall}]) \\
 &= \text{MLR}_{\text{IV}, [\text{AGR}(\text{ob}):3\text{pl}/\text{class2}]} \\
 &\quad \text{applied to } \text{MLR}_{\text{III}, [\text{AGR}(\text{su}):1\text{sg}]} \\
 &\quad \text{applied to } \text{MLR}_{\text{II}, [\text{PRET}:\text{yes}]} \\
 &\quad \text{applied to } \text{MLR}_I, [\text{TNS}:\text{relative past}, \text{VCE}:\text{active}]([v\ \text{wall}]) \\
 &= [v\ [v\ [v\ [v\ [v\ \text{wall}]\ \text{U}]\ \text{noo}]\ \text{mi}]\ \text{be}] \\
 &(\rightarrow [v\ [v\ [v\ [v\ [v\ \text{mball}]\ \text{u}]\ \text{noo}]\ \text{mi}]\ \text{be}'], \text{ by} \\
 &\quad \text{morphophonemic rules})
 \end{aligned}$$

But the default clause in (64e/i) is overridden by the second clause, according to which the four morpholexical functions apply in the sequence in (62b) when *-mi* and either *-maa* or *-mo* are involved. Thus, the form *mball-u-no-moo-mi* ‘I had helped him’ in (60i) is identified as the relative past active preterite form of *wall-* with first person singular subject agreement and third person singular (class 1) object agreement:

$$\begin{aligned}
 (66) \quad \text{Where } [\sigma] &= \left[\begin{array}{l} \text{AGR}(\text{su}):1\text{sg}, \text{TNS}:\text{relative past}, \text{VCE}:\text{active}, \text{PRET}:\text{yes}, \\ \text{AGR}(\text{ob}):3\text{sg}/\text{class1} \end{array} \right] \\
 \text{PF}_{[\sigma]}([v\ \text{wall}]) &= \text{MLF}_{(\text{III} \circ (\text{IV} \circ (\text{II} \circ \text{I}))), [\sigma]}([v\ \text{wall}]) \\
 &= \text{MLR}_{\text{III}, [\text{AGR}(\text{su}):1\text{sg}]} \\
 &\quad \text{applied to } \text{MLR}_{\text{IV}, [\text{AGR}(\text{ob}):3\text{sg}/\text{class1}]} \\
 &\quad \text{applied to } \text{MLR}_{\text{II}, [\text{PRET}:\text{yes}]} \\
 &\quad \text{applied to } \text{MLR}_I, [\text{TNS}:\text{relative past}, \text{VCE}:\text{active}]([v\ \text{wall}]) \\
 &= [v\ [v\ [v\ [v\ [v\ \text{wall}]\ \text{U}]\ \text{noo}]\ \text{mo}]\ \text{mi}] \\
 &(\rightarrow [v\ [v\ [v\ [v\ [v\ \text{mball}]\ \text{u}]\ \text{no}]\ \text{moo}]\ \text{mi}'], \text{ by} \\
 &\quad \text{morphophonemic rules})
 \end{aligned}$$

The fundamental generalization underlying this account of the Fula data is this: where *m* and *n* are two REVERSIBLE position classes, MLF_m and MLF_n apply in opposite orders in different clauses of the definition of the same paradigm function.

This account of the Fula reversible position classes seems optimal in all respects but one: the two clauses in the definition of the paradigm function

schema (64e) are redundant to the extent that they repeat the ordering of MLF_{II} with respect to MLF_I and of both MLF_{III} and MLF_{IV} with respect to MLF_{II} and MLF_I . This redundancy could be eliminated by introducing a special morpholexical function MLF_{AGR} encompassing both MLF_{III} and MLF_{IV} ; its definition would be as in (67):

(67) Definition of MLF_{AGR}

- a. By default, $MLF_{AGR, [\sigma]}([_V x]) =_{\text{def}} MLF_{(IV \circ III), [\sigma]}([_V x])$
- b. But: where $[\sigma] = [AGR(su):1sg, TNS:relative\ past, VCE:\alpha, PRET:\beta, AGR(ob):\gamma]$ and $\gamma = 2sg$ or $3sg/class1$, $MLF_{AGR, [\sigma]}([_V x]) =_{\text{def}} MLF_{(III \circ IV), [\sigma]}([_V x])$

Given this definition, the paradigm function schema in (64e) could then be defined nonredundantly as in (68):

(68) Paradigm function schema for Fula verbal inflection (alternative definition)

Where $[\sigma] = [AGR(su):\alpha, TNS:\beta, VCE:\gamma, PRET:\delta, AGR(ob):\varepsilon]$, $PF_{[\sigma]}([_V x]) =_{\text{def}} MLF_{(AGR \circ (II \circ I)), [\sigma]}([_V x])$

The introduction of morpholexical functions such as MLF_{AGR} would, however, constitute a complication of the overall theory: in the case of every other morpholexical function postulated up to this point, the value of the function is determined by the interaction of a set of morpholexical rules with three universal principles (the Identity Function Default, the Function Composition Default, and the Maximal Subset Override); the value of MLF_{AGR} , however, would not be determined in this way, but would instead depend upon the language-particular definition in (67). For present purposes, I shall leave open the question of whether the postulation of specially defined functions such as MLF_{AGR} is a well-motivated extension of the paradigm function approach.

11. REVERSIBLE POSITION CLASSES AND THE PS AND LINEAR ORDERING APPROACHES

Neither the PS approaches nor the linear ordering approach affords as good an account of reversible position classes. Consider first the possibility of developing a subcategorization analysis of the Fula data; consider, in particular, the problem of blocking such nonoccurring forms as **mball-u-mi-moo*, in which the third person singular (class 1) object agreement suffix *-mo* is 'outside of' the first person singular subject agreement suffix *-mi*. Recall that in the paradigm function analysis proposed in (64), the distribution of subject and object agreement affixes in relative past tense verb forms is regulated by a general default and a specific override: according to the default clause in the definition of the paradigm function schema (64e), object agreement affixes are hierarchically outside of subject agreement affixes; but this default is overridden by the second clause of (64e) when the affixes involved are

-*mo* and -*mi*. It is this override relation that guarantees the nonoccurrence of **mball-u-mi-moo*' in the paradigm function analysis. The subcategorization approach, however, is incapable of expressing an override relation of this sort. In this approach, the suffix -*mo* would have to have two subcategorization restrictions: a restriction such as (69a) allowing it to join with forms already marked for subject agreement (as in the formation of *mball-u-daa-mo* 'you (sg.) helped him' (= (60e))) and a second restriction such as (69b) allowing it to join with forms which have not yet been marked for subject agreement (as in the formation of *mball-u-moo-mi* 'I helped him' (= (60i))). In order to prevent **mball-u-mi-moo*', (69b) would somehow have to be interpreted as overriding (69a) in those cases in which the subject agreement suffix is first person singular. But since (69b) is only satisfied by forms which have not yet been marked for subject agreement, there is no straightforward way of expressing this override relation — and one might, in any event, question the novel assumption that subcategorization restrictions may participate in default/override relations (an assumption without precedent in the domain of syntax). The only obvious alternative would be to replace the specification [AGR(su):*marked*] in (69a) with a list of all of the [AGR(su)] specifications compatible with the insertion -*mo* (which would exclude the specification [AGR(su):1sg]); but this, again, would be abandoning the view that the distribution of -*mo* is regulated by one default and one override.

(69) Subcategorization restrictions on -*mo*

- a. +[$\begin{array}{c} \text{V} \\ \text{[AGR(su):marked} \\ \text{TNS:marked} \\ \text{VCE:marked} \\ \text{PRET:marked} \\ \text{AGR(ob):unmarked]} \end{array}$] b. +[$\begin{array}{c} \text{V} \\ \text{[AGR(su):unmarked} \\ \text{TNS:marked} \\ \text{VCE:marked} \\ \text{PRET:marked} \\ \text{AGR(ob):unmarked]} \end{array}$]

The pure PS approach affords no better account of reversible position classes. In order to generate both *mball-u-mi-be* 'I helped them' and *mball-u-moo-mi* 'I helped him', two separate rewrite rules would seemingly be necessary on this approach, as in (70). Besides being massively redundant, these rewrite rules — like the subcategorization restrictions in (69) — fail to determine the distribution of -*mo* in terms of an overridden default. Because it comprises two complementary distributional statements, the analysis in (70) is formally and conceptually more complicated than a default/override analysis.

(70) a. Where $\langle \alpha, \delta \rangle = \langle 1\text{sg}, 2\text{sg} \rangle$ or $\langle 1\text{sg}, 3\text{sg/class1} \rangle$,

- $\begin{array}{c} \text{V} \\ \text{[AGR(su):}\alpha \\ \text{TNS:}\beta \\ \text{VCE:}\gamma \\ \text{PRET:no} \\ \text{AGR(ob):}\delta] \end{array} \rightarrow \begin{array}{c} \text{V} \\ \text{[TNS:}\beta \\ \text{VCE:}\gamma] \end{array} \begin{array}{c} \text{Af} \\ \text{[AGR(ob):}\delta] \end{array} \begin{array}{c} \text{Af} \\ \text{[AGR(su):}\alpha] \end{array}$

b. Where $\langle \alpha, \delta \rangle$ is other than as in (70a),

V	→	V	Af	Af	Af
$\begin{bmatrix} \text{AGR(su):}\alpha \\ \text{TNS:}\beta \\ \text{VCE:}\gamma \\ \text{PRET:no} \\ \text{AGR(ob):}\delta \end{bmatrix}$		$\begin{bmatrix} \text{TNS:}\beta \\ \text{VCE:}\gamma \end{bmatrix}$	$[\text{AGR(su):}\alpha]$	$[\text{AGR(ob):}\delta]$	

Reversible position classes pose a different but equally serious problem for the linear ordering approach to position classes. The four sets of morphological rules proposed in (64a–d) cannot simply be ‘translated’ into four linearly ordered blocks of disjunctively ordered rules, since there would be no linear ordering of these blocks which could successfully generate all of the forms in (60). In order to account for these forms, a proponent of the linear ordering approach would instead have to postulate six different position classes, corresponding to the six rule blocks in (71).

(71) A linear ordering analysis of Fula relative past tense verb forms

- a. Rule block A: rules for tense/voice suffixes
- b. Rule block B: *noo*-suffixation (realizing [PRET:yes])
- c. Rule block C: rules for all subject agreement affixes except *mi*
- d. Rule block D: *maa*-suffixation (realizing [AGR(ob):2sg])
mo-suffixation (realizing [AGR(ob):3sg/class1])
- e. Rule block E: *mi*-suffixation (realizing [AGR(su):1sg])
- f. Rule block F: rules for all object agreement suffixes except *-maa, -mo*

g. Linear ordering of rule blocks: A : B : C : D : E : F

In this analysis, the object agreement rules of *maa*-suffixation and *mo*-suffixation together constitute a separate rule block D, and the subject agreement rule of *mi*-suffixation alone constitutes a separate rule block E; block D is linearly ordered before block E, and both blocks are ordered between the main block C of subject agreement rules and the main block F of object agreement rules. According to this analysis, the affix sequences in the preterite forms in (72a) reflect the sequential application of the corresponding rule blocks in (72b):

(72) a.	mball-u-noo-mi-be' 'I had helped them' (= (60h))	b.	A : B : E : F
	mball-u-no-moo-mi' 'I had helped him' (= (60i))		A : B : D : E
	mball-u-noo-don-be' 'you (pl.) had helped them' (= (60f))		A : B : C : F
	mball-u-noo-don-mo' 'you (pl.) had helped him' (= (60g))		A : B : C : D

This system of linearly ordered rule blocks manages to generate all of the

forms in (60), but in doing so it misses a key generalization. The fact that at most four of the six rule blocks ever participate in generating a given inflected form is depicted as pure coincidence in (71); that is, (71) provides no explanation for the fact that the application of block C happens to be mutually exclusive with that of block E, and the application of block D, with that of block F. On the other hand, this generalization follows as a theorem of the paradigm function analysis (64) proposed earlier. Blocks C and E in (71) together correspond to a single morpholexical function (MLF_{III}) responsible for all subject agreement inflection in (64); similarly, blocks D and F in (71) together correspond to a single morpholexical function (MLF_{IV}) responsible for all object agreement inflection in (64). Thus, each of the four-affix sequences in (72a) reflects the same four morpholexical functions in (64), in accordance with the paradigm function schema (64e). The ease with which the paradigm function approach accommodates reversible position classes stems from the fact that it makes the specification of a position class' membership logically separate from the specification(s) of that class' hierarchical location: membership is determined by morpholexical rules and functions, while hierarchical location is determined by paradigm functions. The defect of the linear ordering approach is that it entails that an affix's membership in a particular position class is both necessary and sufficient for its appearance in a particular hierarchical location.²⁵

12. CONCLUSION

In the PS approaches to affix order, the specification of an affix's prefixal or suffixal status is not distinct from the specification of its hierarchical position in the structure of an inflected form: this specification takes the form of a subcategorization restriction in the one approach, and that of a rewrite rule in the other. In the paradigm function approach, on the other hand, the prefixal or suffixal status of an affix is specified separately from its hierarchical position in word structure. More exactly, the operation by which an affix is introduced is specified separately from the position of that operation in the sequence of operations by which a word's inflection is realized: morpholexical rules do the first sort of specification, while paradigm function schemata (defined in terms of morpholexical functions) do the second. It is this separation between morpholexical rules and paradigm functions that makes it possible for the paradigm function approach to account for the full range of position class phenomena investigated here. It accounts for the existence of ambifixal position classes by allowing different morpholexical rules — some prefixal, others suffixal — to participate in the definition of the same morpholexical function, hence to be associated with the same position in the sequence of inflectional operations; it accounts for the existence of parallel position classes by allowing the same morpholexical rules to participate in the definition of two distinct morpholexical functions, hence to be associated

with two distinct positions in the sequence of inflectional operations; it accounts for the existence of portmanteau position classes by allowing a portmanteau morpholexical rule to compete with the composite of two or more morpholexical functions in the definition of a portmanteau morpholexical function; and it accounts for the existence of reversible position classes by allowing different clauses in the definition of a paradigm function schema to license alternative orderings of the same two morpholexical functions.

In separating the specification of an affix's prefixal or suffixal status from the specification of its hierarchical position in word structure, the paradigm function approach resembles the linear ordering approach; in this latter approach, the prefixal or suffixal status of an affix is specified by the realizational rule which introduces it, but its hierarchical position is determined by the organization of rules into linearly ordered blocks. Nevertheless, that two approaches are far from equivalent, since unlike the paradigm function approach, the linear ordering approach entails a biunique relation between position classes and hierarchical affix positions — that is, it entails that an affix's membership in a particular position class is both necessary and sufficient for its appearance in a particular hierarchical location. As I have shown, this entailment cannot be reconciled with the existence of parallel, portmanteau, and reversible position classes.²⁶

The broader methodological implications of these conclusions should be clear. Much recent work in morphological theory has pursued the idea that word structure is regulated by fundamentally the same kinds of principles as phrase structure; morphology has been argued to be — as much as syntax — the domain of the X-bar system, Quantifier Raising, Case theory, and so on (cf. Selkirk 1982, Pesetsky 1985, Fabb 1988, *et al.*). By contrast, proponents of the Extended Word-and-Paradigm theory of morphology have assumed that rules of inflectional morphology are akin to phonological rules and perhaps even belong in the phonological component of a grammar (Anderson 1982, Thomas-Flinders 1981). The evidence discussed here suggests that both of these conceptions of morphology are in error, and that the morphological component of a grammar possesses a higher level of autonomy than has been customarily assumed in recent, generative theories of morphology. The distinction between morpholexical rules and paradigm functions which I have argued for here and elsewhere has no parallel in the domains of syntax and phonology. This lack of parallelism between the system of morphological rules and the systems of syntactic and phonological rules stems directly from the fact that morphological structures belong to PARADIGMS, a notion which has no exact analogue in the domain of either syntactic or phonological structures. Further inquiry into the theoretical status of paradigms is likely to uncover additional fundamental contrasts between morphology and other components of grammatical organization.

APPENDIX: DISTINGUISHING MORPHOLEXICAL RULES FROM
AFFIX LINEARIZATION RULES

In the analysis of Swahili verb morphology proposed in (30), the formal identity between the relative prefixes and their suffixal counterparts is accounted for by means of a metarule (namely (30)*F*) which predicts the latter from the former. In this appendix, I discuss a very different way of accounting for this formal identity within a radically revised variant of the paradigm function framework: in this revised framework, morpholexical rules would define the hierarchical relations among a word's morphological constituents but not their linear ordering, which would instead be determined by an independent set of linearization rules. On this approach, all relative affixes could be introduced by the same set of morpholexical rules, since the prefixal status of relative affixes in tensed or negative forms and the suffixal status of relative affixes in tenseless, positive forms would only emerge once linearization had taken place. For example, a single morpholexical rule introducing all instances of the singular personal relative affix *ye* into slot II could be stated as in (73), where the notation $[_X y, z]$ is interpreted as referring to an expression of category *X* whose constituents are *y* and *z*, with linear ordering unspecified. The constituents of expressions generated by (73) would then be linearized by means of the rules in (74): by (74a), prefixation would be the default in Swahili; this default would be operative in the evaluation of $\text{MLF}_{\text{II},[\sigma]}(y)$ if $[\sigma]$ included a specification for some tense or for negative polarity, but would be overridden by (74b) if $[\sigma]$ included specifications for both tenselessness and positive polarity.

$$(73) \quad \text{MLR}_{\text{II},[\text{REL}(\mu);[\text{NUM}:\text{sg}, \text{GEN}:\text{m/wa}]]}([_V x]) = [_V [_V x], \text{ye}]$$

$$(74) \quad \text{Where } \text{MLF}_{n,[\sigma]}(y) = [_X y, z],$$

a. $\text{MLF}_{n,[\sigma]}(y)$ is linearized as $[_X z y]$ by default;

b. $\text{MLF}_{n,[\sigma]}(y)$ is linearized as $[_X y z]$
if $n = \text{II}$ and $[\text{TNS}:\text{none}, \text{POL}:\text{pos}, \text{REL}(\mu):[\text{NUM}:\alpha, \text{GEN}:\beta]]$
 $\subseteq [\sigma]$.

Note that because these linearization principles are stated in terms of morpholexical functions rather than morpholexical rules, they would correctly impose the same kind of linear ordering restriction on all of the slot II affixes. In this variant of the paradigm function framework, the formal identity between a relative prefix and its suffixal counterpart is accounted for by assuming that prefix and suffix are introduced by one and the same morpholexical rule; in this way, the members of an ambifixal pair are in effect identified as one and the same affix.

Separating morpholexical rules from affix linearization rules has similarly interesting consequences for cases in which a set of prefixes constituting one position class shows recurrent similarities in both form and content to a set

of suffixes constituting a different position class. An example of this sort occurs in Fula: for each of the Fula noun classes 1 through 25, if $-a$ is the object agreement suffix associated with that class, then $a-$ is the corresponding series I subject agreement prefix;²⁷ for instance, $-be$ is the third person plural object agreement suffix for class 2, and $be-$ is the corresponding series I subject agreement prefix (Arnott 1970: 212). Though reminiscent of ambifixal pairs, these paired subject and object agreement affixes do not belong to a single, ambifixal position class, but instead belong to two separate position classes (and may therefore perfectly well cooccur).

In a framework in which affix linearization rules were systematically distinguished from morpholexical rules, these two classes of agreement affixes could — prior to linearization — be treated in exactly the same way as the parallel position classes in (30)G.²⁸ For instance, a single morpholexical rule introducing both the above-mentioned subject agreement affix be into slot III and the corresponding object agreement affix be into slot IV could be stated as in (75), where g is the function $\{\langle su, III \rangle, \langle ob, IV \rangle\}$ and the notation $[x\ y\ z]$ is interpreted as before; as it is stated, (75) participates in the definition of both the morpholexical function MLF_{III} for subject agreement and the morpholexical function MLF_{IV} for object agreement. The constituents of expressions generated by (75) would be linearized by means of the rules in (76): by (76a), suffixation would be the default in Fula; this default would be operative in the evaluation of MLF_{IV} , but would be overridden by (76b) in the evaluation of MLF_{III} .

$$(75) \quad MLR_{g(\mu), [AGR(\mu):3pl/class2]}([v\ x]) = [v\ [v\ x], be]$$

$$(76) \quad \text{Where } MLF_{n,[\sigma]}(y) = [x\ y\ z],$$

- a. $MLF_{n,[\sigma]}(y)$ is linearized as $[x\ y\ z]$ by default;
- b. $MLF_{n,[\sigma]}(y)$ is linearized as $[x\ z\ y]$ if $n = III$ (in the appropriate tenses).

Further inquiry will be necessary to determine the extent to which this conception of morphology can be convincingly motivated by other sorts of evidence.

NOTES

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¹ In the PS solutions sketched in Section 1.1.1–2 as well as in the realizational solutions sketched in 1.2.1–2, no account is taken of noun class concord. See Sections 5–8 for a more detailed account of noun class concord under all four approaches to Swahili verb agreement.

² The values assumed for the feature [TNS] in (2b/i) are based on the terminology of Ashton

(1944: 35f); as one referee noted, Ashton's 'definite' tense might be more perspicuously labelled 'imperfective present'.

³ The assumption here is that for any category C of lexemes in a language, the class of complete, fully specified, and internally consistent sets of morphosyntactic features appropriate to members of C is determined independently of the rules which realize the inflectional exponents of these sets of feature specifications.

⁴ I follow Matthews (1972: 165) in using ROOT to refer to the basic form of a lexeme upon which the words in that lexeme's paradigm are built; STEM refers to an intermediate form in the development of a word from a root.

⁵ The inventory of position classes in (15) is not exhaustive, but characterizes the 'fragment' of Swahili verbal morphology under consideration here. For a more comprehensive description of Swahili verbal position classes, see Ashton (1944) and Schadeberg (1984).

⁶ As Ashton (1944: 99–100) points out, most of these affixes can be analyzed as the combination of a noun class agreement affix with a pronominal element *o* (which she refers to as the '-*o* of reference'); thus, *ki + o > cho*, *vi + o > vyo*, and so on. Whether this analysis of the relative affixes is best regarded as purely etymological or as having synchronic validity is an open question; cf. Schultink (1988). For reasons of expository simplicity, I shall treat the Swahili relative affixes as if they were synchronically unanalyzable; this would not be an unreasonable assumption to make, given that one such affix — the singular personal affix *ye* — cannot be plausibly analyzed in terms of the -*o* of reference (as Ashton notes) but is nevertheless distributionally parallel to the others. In any event, the arguments developed here do not depend on the assumption that the relative affixes are unanalyzable; a comparable set of arguments could be built upon the assumption that the relative affixes in (16) are morphologically complex.

Note that the affixes listed in (16) are those used in the formation of 'pronominal relatives', in which a subject or object is relativized. Swahili also possesses four affixes (*ko*, *po*, *mo*, and *vyo*) used in the formation of 'adverbial relatives' (Ashton (1944: 168f)); these are associated with the locative classes *ku-*, *pa-*, and *mu-* and the manner class *vi-*, respectively.

⁷ Throughout, I shall employ the following abbreviatory conventions in glossing the formatives within a word: ACT = active voice affix; AGR(su) = subject agreement inflection; AGR(ob) = object agreement inflection; CL.*n* = noun class *n*; EMPH:PAST = emphatic past tense; EXCL = exclusive; GEN.*n* = gender *n*; GEN:PAST = general past tense; INCL = inclusive; INF = infinitive affix; NEG = negative marker; PL = plural number; PRET = preterite affix; REL = relative affix; REL:FUT = relative future tense; REL:PAST = relative past tense; SG = singular number; TNS = tense affix.

⁸ The affixes in (16) are also employed in a separate, analytic relative construction in which they attach suffixally to an otherwise uninflected formative *amba-* rather than to the verb of the relative clause; see Ashton (1944: 113f, 309ff) and Schadeberg (1984: 17; 1989).

⁹ To my knowledge, the conception of ambifixal position classes advocated here was first suggested by Anderson (1982: 602–603; 1986: 4).

¹⁰ Arnott (1970: 218) points out one apparent exception to this otherwise general pattern. In the general past passive, whose characteristic tense suffix is *-aama*, *-no(o)* is placed between the two syllables of the tense suffix: '*o-naŋŋg-aama* 'he has been caught' (non-preterite), '*o-naŋŋg-a-noo-ma* 'he had been caught' (preterite). One way of reconciling this irregularity with the general pattern would be to assume that *-aama* is itself complex, consisting of (i) a suffix *-aa* whose distribution parallels that of the other tense suffixes, and (ii) a second suffix *-ma* whose distribution is external to the positions occupied by the tense suffixes and by *-no(o)*.

¹¹ The full inventory of subject agreement affixes is much larger, since the 'nonpersonal' genders have their own distinctive subject agreement affixes.

¹² There is a highly circumscribed class of exceptions to the claim that the subject agreement affixes in (25) appear "inside of" any object affix; this class of cases is discussed in detail in Sections 9–11.

¹³ On this view, the fact that the relative suffixes are mutually exclusive with the tense/

negation prefixes is not attributed to membership in the same position class, but instead simply follows from the incompatibility of their feature specifications.

¹⁴ Note that adverbial nouns in the locative classes *ku-*, *pa-*, and *mu-* may also function as subjects (though not as objects), in which case the verb takes *ku-*, *pa-*, or *mu-* as its subject concord; see Ashton (1944: 127ff).

¹⁵ This is not to be identified with the negative prefix *si-* appearing in tenseless relative verb forms: the *si-* in (29) only appears in forms with first person singular subjects, it can accompany overt tense marking, and because it is associated with slots V and IV, it precludes the appearance of the usual first person singular subject agreement prefix; the *si-* in tenseless negative relatives, on the other hand, cooccurs with subject agreement affixes of every person, number, and gender, and because it occupies slot III, it precludes the appearance of overt tense marking.

Because the negative prefixes *ha-* and *si-* in (29) do not appear in relative verb forms, they might be regarded as realizing a negative specification for the feature of relative concord, just as the *si-* of tenseless negative relatives realizes a positive specification for this same feature.

¹⁶ Throughout, I shall employ the following abbreviated feature names: AGR 'agreement', GEN 'gender', NUM 'number', PERS 'person', POL 'polarity', PRET 'preterite', REL 'relative', TNS 'tense', and VCE 'voice'.

There are, of course, Swahili tenses other than those listed in (31a) and genders other than those listed in (31b), but because these would be parallel in their treatment to the three tenses and two genders in (31), the latter will, for the sake of expository brevity, be taken as representative.

¹⁷ The Maximal Subset Override is simply the Elsewhere Condition applied to the evaluation of morpholexical functions. See Stump (1991a) for instances in which the Elsewhere Condition regulates the evaluation of paradigm functions; see also Stump (1989) for discussion of some of the limits on the applicability of the Elsewhere Condition in the domain of morphology.

For the purposes of this paper, I shall assume that the value of a morpholexical function for a given argument is always uniquely determined by the Identity Function Default and the Maximal Subset Override (in combination with the Function Composition Default, discussed below). It is conceivable, however, that language-particular restrictions on the evaluation of morpholexical functions may occasionally be necessary. For instance, if there were two morpholexical rules $MLR_{n,[\tau]}$ and $MLR_{n,[\tau']}$ such that $[\tau], [\tau'] \subseteq [\sigma]$ but $[\tau] \not\subseteq [\tau']$ and $[\tau'] \not\subseteq [\tau]$, then the two principles in (33b) would fail to determine a unique value for $MLF_{n,[\sigma]}(x)$; in such cases, the grammar would seemingly have to stipulate that one of the two competing morpholexical rules simply takes priority over the other in the evaluation of $MLF_{n,[\sigma]}$. Anderson (1986: 7f) discusses an apparent case of this sort from Georgian.

¹⁸ As it is stated, the Function Composition Default can apply recursively in determining the value of a morpholexical function; this property allows for the existence of portmanteau position classes which supplant a sequence of three or more consecutive position classes. For instance, $MLF_{(m \circ (n \circ o))}$ could spell out the members of a portmanteau position class supplanting slots *m*, *n*, and *o*.

¹⁹ As noted in Note 8, the relative affixes may also be suffixed to a special formative *amba-* employed in an analytic relative construction; on the assumption that *amba-* carries a specification for the morphosyntactic feature $[REL(\mu)]$, its inflection could be provided for by a morpholexical metarule comparable to (30)*F*.

²⁰ This is not to say, however, that an affix's linear ordering relations cannot be defined separately from its sisterhood relations; see the appendix, where I discuss the possibility of a modified paradigm function approach in which rules of affix linearization are distinguished from morpholexical rules.

²¹ The assumption that the subject and object agreement markers in Fula are affixes is not universally held. Arnott (1970) — who describes the Gombe dialect of Fula — maintains a neutral stance regarding these markers (referring to them as 'subject elements' and 'object

elements' in the Fula verbal complex). In her description of the Kaceccereere dialect, however, McIntosh (1984: 162ff) argues that while some of the subject and object agreement markers are true affixes, those having identical pronominal counterparts in verbless or nonfinite contexts are not affixes, but rather words or clitics. There are, however, good grounds for questioning this conclusion. Even those agreement markers which have identical pronominal counterparts nevertheless stand in a paradigmatic relationship with the other, unequivocally affixal markers (in the sense that they encode the same morphosyntactic features of person, number, and gender and are complementary in their distribution); moreover, they may actually alternate with such affixes according to the tense of the verb. I would argue, therefore, that while the subject and object agreement markers may have developed historically from clitic pronouns, they have nevertheless become integrated into the Fula system of affixal verb morphology and are thus comparable to the preterite affix *no(o)* discussed in Section 2: even though *no(o)* has a free adverbial counterpart *no* 'formerly' appearing in verbless contexts, the two must clearly be distinguished synchronically, since *no(o)* possesses several properties which clearly identify it as an affix (as McIntosh acknowledges (p. 166)).

²² The full inventory of object agreement affixes is much larger, since the 'nonpersonal' genders have their own distinctive object agreement affixes.

²³ A complete account of Fula morphology would, of course, include a broader range of possible values for the features [AGR(su)], [TNS], and [AGR(ob)]; these are irrelevant to the questions at issue here and are omitted in the interests of expository brevity.

²⁴ I assume that in addition to the morpholexical rules in (64), the grammar of Fula also comprises a set of morphophonemic rules. I assume that these would account for the following sorts of allomorphy observed in relative past tense verb forms:

- (a) Alternating roots such as *wall-* 'help' assume their F-grade alternant in the third person singular (e.g. *wall-* in (60a–c)) and their N-grade alternant elsewhere (e.g. *mball-* in (60d–j)); see Arnott (1970: 42ff, 187, 204f) for details concerning this system of initial consonant gradation.
- (b) The default relative past active suffix, represented by Arnott as *-U*, is realized as *-u* with Type 1 roots (as in (60d–j)), has no phonological realization with Type 2 roots, and is realized as an optional *-u* with Type 3 roots; see Arnott (1970: 187f) for the properties distinguishing these three classes of roots.
- (c) The relative past active suffix *-i* (used only in the first person plural and in the third persons, as in (60a–c)), the relative past middle suffix *-ii*, the relative past passive suffix *-aa*, and the preterite suffix *-noo* have the respective short alternants *-U*, *-i*, *-a*, and *-no* (where *-U* participates in the alternation described in (b)). These short alternants appear anytime a long-vowelled suffix follows (as in 'o-*wall-u-maa*' 'he helped you (sg.)' (= (60c)), 'o-*wall-u-noo-be*' 'he had helped them' (= (60a)), and in preterite forms such as *mball-u-no-maa-mi* 'I had helped you (sg.)' (= (60j)); see Arnott (1970: 219f, 224ff) for details.
- (d) The third person singular class 1 object agreement suffix *-mo* has the long alternant *-moo* in first person singular verb forms (as in (60i)); see Arnott (1970: 211ff) for details.
- (e) The presence or absence of final glottality (indicated by " in (60)) is predictable: all relative past tense forms exhibit final glottality unless they end with a first or second person object agreement suffix other than *-maa* or with the non-concording third person singular object suffix *-dum*; see Arnott (1970: 231ff) for details.

²⁵ Anderson (1977: 36) and Thomas-Flinders (1981: 78) raise the possibility that blocks of inflectional rules are subject to the principles of local ordering, according to which two rules tend to apply in the order which promotes self-preservation, feeding, counterbleeding, and transparency to the greatest extent (Anderson (1974: 137–218)). It is not clear, however, that such principles shed any light on the phenomenon of reversible position classes.

²⁶ Inkelas (1992) has recently suggested that a position class is simply a class of affixes introduced at the same stratum in a level-ordered morphology. I suspect, however, that this approach would encounter some of the same difficulties as the linear ordering approach; in particular, I question whether it could account for parallel and reversible position classes.

²⁷ The series I subject agreement prefixes are used in several tenses; the general past, emphatic past, general future, vague future, negative past, negative future, and negative of quality (Arnott 1970: 193).

²⁸ In a framework in which morpholexical rules were not distinguished from affix linearization rules, the two position classes in question would not submit to the same sort of analysis as those in (30)G; to minimize the redundancy of the morpholexical rules spelling out the affixes belonging to these two classes, one would instead have to resort to a morpholexical metarule predicting the class of subject agreement prefixes associated with slot III from the class of object agreement suffixes associated with slot IV (or *vice versa*).

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