Chapter 5. Reference to lexical types

5.1 Introduction

Whether there are limits on the amount of morphological information that phonology is allowed to access, and, if so, what the limits are, has been the topic of much debate in the past decades. In the earliest cyclic approaches to phonology (Chomsky et al. 1956, Chomsky and Halle 1968), the erasure of internal morphological boundary symbols at the end of each cycle (Bracket Erasure) was used as a mechanism that drove the cyclic derivation. Little emphasis was placed at that time on restricting reference by the phonology to morphological information. In fact, the constituent structure tree was assumed to be intact, making possible global reference to previous stages of the derivation.

The observation that information from inner cycles is not accessed by the phonology of outer cycles (Siegel 1974, 1978, Allen 1978) formed one of the original motivations for the framework of Lexical Phonology, starting with Pesetsky 1979 and crystallized in Kiparsky 1982, Mohanan 1982, 1986. The exact formulation of Bracket Erasure has been controversial, and various modifications have been proposed.

With the current trend toward noncyclic phonological analyses, the issue of limiting phonological access to internal morphological structure has been more or less abandoned. Work in Optimality Theory (Prince and Smolensky 1993), for example, has had no reservations about making all morphological information available to all phonology. Now that Optimality Theory has developed in considerable detail, and a more or less direct approach to cyclic phonological effects is being actively pursued within the Optimality Theory tradition (Orgun 1994b, Orgun 1995a, Benua 1995, Kenstowicz 1995, McCarthy 1996), it may be profitable to reconsider the status of Bracket Erasure effects in the phonology-morphology effects.

This chapter takes up the important issue of Bracket Erasure effects, arguing not only that Sign-Based Morphology captures them as an automatic consequence of the theory, but also that Sign-Based Morphology makes the novel, and correct, prediction that phonology and morphology will exhibit different degrees of sensitivity to internal morphological structure. In particular, it follows from the architecture of Sign-Based Morphology that phonology may only access the immediate constituents of the node it is applying to, while morphology can indirectly refer to information about the "granddaughters" of the top node (that is, to the immediate constituents of the immediate constituents of the top node). Effectively, morphology can see one level deeper than phonology. Much of this chapter will be devoted to demonstrating that this new prediction is supported by data, some of which have been presented as evidence against Bracket Erasure in the past literature, and some of which is introduced here for the first time. By allowing just the right amount of information to be visible to the morphology and the phonology, Sign-Based Morphology makes possible a strict approach to Bracket Erasure that has proved elusive in other approaches.

I therefore conclude that there is still a place for Bracket Erasure effects in modern phonological theory, and that approaches (such as, for example, the Generalized

Alignment framework of McCarthy and Prince (1993), the “constraint domains” approach of Buckley (1996) and the current syntagmatic accounts of cyclic phonological effects enriched by transderivational identity proposed by Benua 1995, Kenstowicz 1995, and McCarthy 1996) that allow unlimited reference to internal morphological structure should be treated with skepticism. To the extent that Bracket Erasure effects seem to hold, more restrictive approaches such as Sign-Based Morphology and the loosely paradigmatic approach of Burzio (1994) are preferable.[47]

5.2 Reasons to revive Bracket Erasure

The most obvious reason to revive Bracket Erasure effects is the never-ending quest for a restrictive theory of grammar. Current work in the phonology-morphology interface has not paid much attention to Bracket Erasure (Hammond 1991, Goldsmith 1993, Karttunen 1993, Lakoff 1993, McCarthy and Prince 1993, Hyman 1994, Kennedy 1994, Kenstowicz 1995, Benua 1996, Buckley 1996). However, the question of Bracket Erasure holds a treasure trove of interesting linguistic facts to be uncovered.

5.2.1 Illustration of Bracket Erasure

A quick example illustrates how Bracket Erasure gives rise to a more restrictive theory, and is therefore not to be abandoned without careful consideration. The example has to do with stress-perturbing suffixes in Turkish (Sezer 1981b, Barker 1989, Inkelas 1994, Inkelas and Orgun 1996). After presenting the range of stress-perturbing behavior, I illustrate how a theory without Bracket Erasure can, by minor modifications of the Turkish stress system, predict the existence of certain types of stress behavior never attested in languages. I conclude that a theory without Bracket Erasure is unprincipled.

In the bulk of the Turkish lexicon, stress is word-final. Monomorphemic words with final stress are shown in (274):

(274)	ɑdɑ́m	‘man’
	bebékʲ	‘baby’
	dymbelékʲ	‘drum’
	eníkʲ	‘pup’
	ferɑːgɑ́t	‘withdrawal’
	gɑniːmét	‘booty’
	hemʃiːré	‘nurse’
	ilʲíkʲ	‘marrow’
	kɑdɯ́n	‘woman’

47 Note that the only difference between the loosely paradigmatic approach and the transderivational approach is that the latter allows global reference to underlying forms. Since this tool has never been crucially used, it is reasonable to suspect that it may be unnecessary. The transderivational identity approach then becomes identical to the loosely paradigmatic approach, which in turn is quite similar to Sign-Based Morphology.

Many suffixes are stress-neutral—they do not interfere with the assignment of default word stress. Stress is final in words containing those suffixes (275):

(275)	a)	év	‘house’
		ev-lʲér	‘house-pl’
		ev-lʲer-ím	‘house-pl-1sg.poss’
		ev-lʲer-im-dé	‘house-pl-1sg.poss-loc’
		ev-lʲer-im-de-kʲí	‘house-pl-1sg.poss-loc-rel’
	b)	gʲedʒíkʲ	‘be late’
		gʲedʒikʲ-tír	‘be late-caus’
		gʲedʒikʲ-tir-ílʲ	‘be late-caus-pass’
		gʲedʒikʲ-tir-ilʲ-ír	‘be late-caus-pass-imprf’
		gʲedʒikʲ-tir-ilʲ-ir-lʲér	‘be late-caus-pass-imprf-3pl.sbj’

Although stress is usually final, there are several sources of non-final stress. We will not be concerned with two of these: place names and foreign names have a particular pattern of non-final stress (Sezer 1981b, Inkelas 1994, Inkelas and Orgun 1996) (276a). I have already discussed this stress pattern in section 4.7.3. There are also some lexical entries with idiosyncratic non-final stress (276b) (Inkelas 1994, Inkelas and Orgun 1996):

(276)	a)	istɑ́nbul	‘Istanbul’
		ɑdɑ́nɑ	‘Adana’
		ɑ́nkɑrɑ	‘Ankara’
		ɑntɑ́lʲjɑ	‘Antalya’
	b)	pendʒére	‘window’
		tendʒére	‘pot’
		tɑrhɑ́nɑ	‘curd’
		zónguldɑk	‘Zonguldak (place name)’[48]

The type of stress-perturbing behavior we are interested in is exhibited by certain affixes. There are two kinds of stress-perturbing affixes: some are prestressing, putting stress on the last syllable of the stem they attach to (277a). Others are self-stressing (277b). They have stress on their first syllable (affixes of this type are always polysyllabic. See Inkelas 1994, McCarthy 1996a for a discussion of the significance of this point).

48 Zonguldak is one of several place names that have idiosyncratic non-Sezer stress. Other examples are: kastámonu (*kastamónu), yskʲýdɑr (*ýskʲydɑr).

(277) a) Prestressing suffixes

i) -me ‘negative’

gʲetír	‘bring’
gʲetír-me	‘bring-neg’
gʲetír-me-di	‘bring-neg-past’

ii) -(j)lE ‘comitative’

kʲitáp	‘book’
kʲitáp-la	‘book-com’

iii) -Im ‘1st person singular subject’

uzún	‘tall’
uzún-um	‘tall-1sg.sbj’

b) Self-stressing suffixes

i) -ijor ‘progressive’

gʲetir-íjor	‘bring-prog’

ii) -ErEk ‘adverbial’

gʲetir-érekʲ	‘bring-adv’

We are primarily interested in prestressing suffixes (277a). Notice that all of these place stress on the syllable that immediately precedes them. When they are added to a complex stem containing a number of stress-neutral suffixes, the last syllable of this whole stem bears word stress (278):

(278)

gʲedʒíkʲ-me	‘be late-neg’
gʲedʒikʲ-tír-me	‘be late-caus-neg’
gʲedʒikʲ-tir-ílʲ-me	‘be late-caus-pass-neg’

Consider a minor variation of the Turkish stress pattern. Imagine a language that puts stress on the root-final syllable whenever a stress-perturbing suffix is added to a word, regardless of intervening suffixes (279):

(279) Hypothetical data

a) All neutral suffixes

gʲedʒikʲ-tir-ilʲ

b) Stress-perturbing suffix following neutral suffixes

gedʒíkʲ-tir-ilʲ-ir

This kind of stress behavior is never attested in cyclic phonology. Yet a theory without Bracket Erasure can describe this pattern quite easily, by, for example, using an alignment constraint that refers to the first morpheme boundary in the stem that a stress-perturbing suffix attaches to. Since phenomena like this are not found in languages, we must be suspicious of a theory without some kind of Bracket Erasure mechanism.

5.2.2 Challenges to Bracket Erasure

A number of cases have been cited in the literature as challenges to Bracket Erasure. I examine some representative cases in detail in the following sections. In this section, I show one example to illustrate the general problem. In section 5.2.3, I present some background information on the theory of lexical types that provides the basic tool for dealing with apparent challenges to Bracket Erasure in Sign-Based Morphology.

One type of challenge to Bracket Erasure that is frequently cited in the literature involves POTENTIATION (Hammond 1991). The term potentiation refers to cases where an affix attaches to bases containing another affix, suggesting that the internal morphological structure of the stem is visible to the outer affix. For example, Bochner 1993 observes that the English suffix *-ment* is only marginally productive in the general lexicon. However, it attaches quite freely to verbs containing the prefix *en-* (280):

(280)				
	entomb	entombment	enforce	enforcement
	embalm	embalmment	enfranchise	enfranchisement
	embarrass	embarrassment	engage	engagement
	embellish	embellishment	engross	engrossment
	embezzle	embezzlement	enhance	enhancement
	emboss	embossment	enjoy	enjoyment
	embrace	embracement	enlarge	enlargement
	embroil	embroilment	enlighten	enlightenment
	employ	employment	enrich	enrichment
	enact	enactment	enroll	enrollment
	encamp	encampment	enslave	enslavement
	encircle	encirclement	entail	entailment
	encompass	encompassment	entangle	entanglement
	encourage	encouragement	enthrall	enthrallment
	encroach	encroachment	enthrone	enthronement
	endorse	endorsement	entrance	entrancement
	enfeeble	enfeeblement	entrap	entrapment

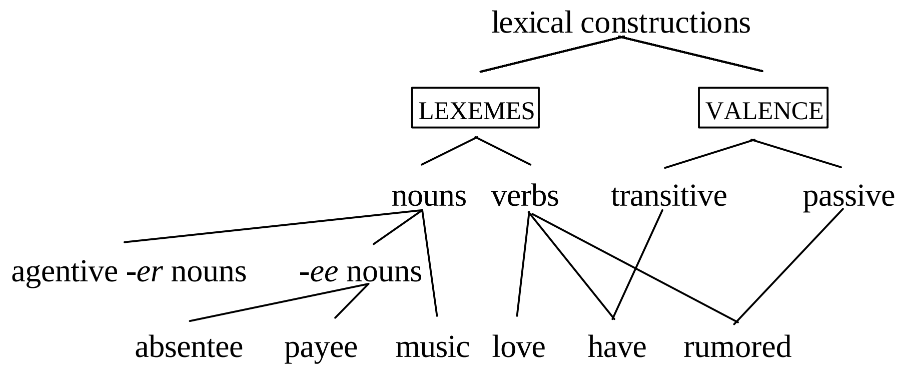
How can a theory that adopts Bracket Erasure deal with data like this? The main observation that leads to my account is that cases like this require knowledge of the fact that a given *morpheme* is present in a stem, but no knowledge of the *location* of that morpheme within the base is needed.

5.2.3 Types

In this section, I introduce the tools necessary to deal with apparent violations of Bracket Erasure such as the one presented above in section 5.2.2. The tool that leads to a satisfactory analysis of such phenomena is type hierarchies. Type hierarchies form a central part of theories such as HPSG quite independently of Sign-Based Morphology's use of them to deal with challenges to Bracket Erasure. Thus, there is no need to stipulate an ad-hoc mechanism to deal with the data in Sign-Based Morphology. In Sign-Based Morphology, as in HPSG, grammatical constructions are organized into a hierarchy of types such that more specific constructions inherit information from more general ones (see Flickinger et al. 1985, Pollard and Sag 1987, Carpenter 1992 for discussion of types, and Flickinger 1987, Ackerman and LeSourd 1993, Koenig and Jurafsky 1994, Riehemann 1994, Orgun 1995c for application to morphology). One of the basic functions of this hierarchy of types is to capture generalizations across constructions by extracting such generalizations into a supertype. Another function of the type hierarchy is to state which features are appropriate to which kinds of items (for examples, nouns have a CASE feature that verbs do not have), and what range of specifications are possible for the value of a given attribute (for example, *accusative* is a possible value of the attribute CASE, while *potato* is not). Constraints imposed on all items of a given type are also stated as holding on the general type (for example, island constraints can be imposed on a general type that subsumes all constructions that function as islands in a language, such that the subcategorization requirements of constructs of that type must be satisfied internally). The type hierarchy is represented as a lattice with the maximally general type at the top, and specific types at the bottom.

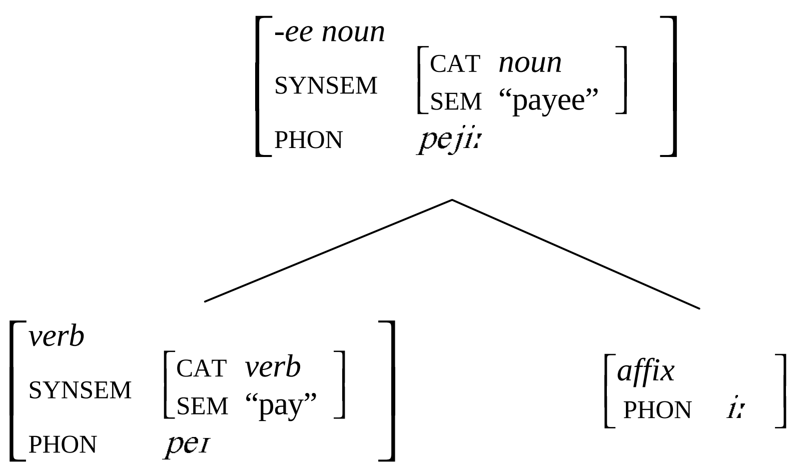
As an example, I present part of the type hierarchy Koenig and Jurafsky 1994 propose for English (much detail is omitted to make the hierarchy simpler):

(281)



The example in (281) illustrates a number of notational conveniences. The labels LEXEMES and VALENCE describe two "dimensions" in the type hierarchy. Any subtype of the type *lexical constructions* must inherit from a type under LEXEMES as well as a type under VALENCE. This is also referred to as a conjunctive branch, since a specification is needed for each branch under it. Under LEXEMES, we have the types *nouns* and *verbs* (along with, of course, other types that have not been listed). Each subtype must inherit from exactly one of these types. Thus, this kind of node is often referred to as a disjunctive branch. The subtypes of *nouns* identified as *-er nouns* and *-ee nouns* are necessary, because the constructions that add the suffixes *-er* and *-ee* must be described somewhere in the grammar. The definitions of these types accomplishes this task, by including information such as the kind of verb these suffixes attach to and the syntactic, semantic, and phonological properties of the resulting nouns. The constituent structure representation of the noun *payee* will be something like (282), where the type of each constituent is indicated by a label in italics above the feature specifications:

(282)



Notice that the mother node of this constituent structure bears the type label *-ee noun*, by virtue of being a construct of English licensed by the *-ee noun* construction. One of the main points of this paper is to show that crucial reference is made by the morphology to these type specifications. This is very fortunate for the theory: by grouping a number of lexical entries into the type *-ee noun*, we are claiming that they form a natural class that we can refer to. We should then expect the grammar to use this information in some fashion, or suspect that there is something wrong with the theory. I will show that not only is it reasonable to suspect that this type information is referred to in the morphology, but that it provides the only principled solution to a number of apparent counterexamples to Bracket Erasure.

5.3 Reference to lexical types in English

In this section, I will present data previously analyzed by Raffelsiefen 1992 concerning zero nominalizations in English. Examination of additional data will reveal interesting consequences for Bracket Erasure.

The construction of interest is what Raffelsiefen calls “stress-shifting nominalization”. Essentially, a disyllabic verb with stress on its second syllable is converted to a noun by placing primary stress on the first syllable and secondary stress on the second syllable. This construction is unproductive, as the data in (283) show. The verbs in (283a) have stress-shifted nominals while those in (283b) do not.

(283)	Verb	Noun	Verb	Noun
	accént	áccènt	accóunt	*áccòunt
	addréss	áddrèss	arrést	*árrèst
	allóy	állòy	allúre	*állùre
	abstrάct	ábstràct	advάnce	*ádvànce
	conflíct	cónflìct	consént	*cónsènt
	contést	cóntèst	concérn	*cóncèrn
	constrúct	cónstrùct	contról	*cóntròl
	decréase	décrèase	deféat	*défeat
	discάrd	díscàrd	disgúst	*dísgust
	discóunt	díscòunt	disdάin	*dísdàin
	expórt	éxpòrt	exhάust	*éxhàust
	misprínt	míisprìnt	mistrúst	*místrùst
	survéy	súrvèy	surpríse	*súrprìse

Even though this stress-shifting nominalization construction is only marginally productive in general, it does have a “niche of productivity”, as Raffelsiefen notes. Verbs that contain the prefix *re-* freely undergo stress-shifting nominalization (284). Each pair in (284a), shows a verb root and its counterpart containing the prefix *re-*. Each pair in (284b) shows a *re*-verb and its stress-shifted nominalization.

(284)

Verb	*re*-verb	*re*-verb	Noun
fill	refíll	refíll	réfìll
do	redó	redó	rédò
make	remáke	remáke	rémàke
load	relóad	relóad	rélòad
paint	repáint	repáint	répàint
play	repláy	repláy	réplày
count	recóunt	recóunt	récòunt
print	reprínt	reprínt	réprìnt
run	rerún	rerún	rérùn
take	retáke	retáke	rétàke

To confirm the productivity of stress-shifting *re*-verb nominalization, I have collected additional data from two native speakers. As expected, all the verbs in (285) have stress-shifted nominalizations.[49,50,51]

(285)

rebore	recross	rehash	re-pose	re-cede	repass	retread
rebound	refit	rejoin	reroute	recast	replant	retrim
recap	refloat	relay	re-serve	recount	replay	revamp
rebuild	re-form	reline	reset	regain	restock	rewind
recharge	refund	remold	resole	reheat	retool	rewire
re-cite	re-fuse	remount	respray	rehang	retouch	rewrite

49 Hyphens are used to distinguish verbs from near-homophones containing the Latinate suffix re- (e.g., reform versus re-form 'form again').

50 Some of these forms sound marginal to some speakers. The sets of stress-shifted nouns that are acceptable and marginal varies from speaker to speaker. This does not mean that the construction is unproductive, but rather is caused by the usual constraint on derivational morphology that forms are acceptable to speakers to the extent that they know what meaning to assign to them. This point is taken up again shortly.

51 The stress-shifted nouns are deverbal rather than derived by adding the prefix re- to a deverbal noun ($\text{fill}_V \rightarrow \text{fill}_N \rightarrow \text{refill}_N$). We know this, because the prefix re- can in fact be added to noun stems. The resulting word has primary stress on the first syllable of the stem (that is, the syllable following re-), as in recápture. The deverbal nouns I am examining in this section do not have this stress pattern. Rather, they have the stress pattern of stress shifted denominal verbs such as súrvèy, which indicates that they are licensed by the stress shifting deverbal nominalization construction rather than by prefixing re- to noun stems.

Although stress-shifting nominalization applies productively to *re*-verbs, it is subject to a number of restrictions. The first restriction is phonological: stress-shifting nominalization does not apply to verbs that contain more than two syllables (Orgun 1995c). None of the verbs in (286) has a stress-shifted nominalization.

(286)	redistribute	recrudesce	re-enter	reinter	re-cover	reproduce
	reconfigure	recriminate	re-establish	reinterpret	re-create	requicken
	reascend	recycle	re-examine	reinvest	re-emerge	restudy
	reassemble	redecorate	re-export	reissue	re-enact	resurface
	rebaptize	recuperate	refashion	rekindle	reinstate	resurvey
	rebroadcast	redeploy	reforest	remilitarize	reinsure	retranslate
	reforecast	redial	regenerate	remodel	repolish	revaccinate
	repredict	reduplicate	rehabilitate	remonetize	repopulate	revalue
	recalesce	re-echo	reimburse	reoccupy	reunite	repeople
	recapitulate	re-edit	reimport	reorient	revalorize	reinsert
	recapture	re-educate	reignite	reorientate	revisit	re-embark
	recognize	re-elect	reinforce	repaper	revivify	recommit

An Optimality-theoretic analysis of the phonology of this construction that accounts for its inapplicability to polysyllabic verbs can be found in section 5.4.

There is a second class of apparent exceptions. The verbs shown in (287) do not undergo stress-shifting nominalization.

(287)	rĕward	rĕform	rĕport	rĕsign	rĕduce	rĕserve	rĕtort
	rĕceive	rĕfuse	rĕpose	rĕsist	rĕfer	rĕsent	rĕtrace
	rĕcite	rĕgard	rĕpress	rĕsolve	rĕfine	rĕside	rĕtract
	rĕcoil	rĕlate	rĕprove	rĕsort	rĕflect	rĕsign	rĕverse
	rĕcede	rĕlax	rĕpute	rĕsound	rĕpeal	rĕstrain	rĕvert
	rĕcount	rĕmind	rĕquest	rĕspect	rĕpel	rĕstrict	rĕview
	rĕcur	rĕmove	rĕquire	rĕspire	rĕplete	rĕsume	rĕvile
	rĕdeem	rĕnew	rĕsect	rĕstore	rĕply	rĕtain	rĕvise
	rĕvive	rĕvoke	rĕvolve				

What these verbs share is that they all contain the Latinate prefix *re*-, which can be distinguished from the English prefix *re*- by its lax vowel, as well as by semantic considerations (287). We therefore conclude that the "niche of productivity" of stress-shifting nominalization is limited to verbs containing the English prefix *re*-. Thus, we need to refer to the specific morpheme in the stem to determine that *re*-verb nominalization may apply productively.

A third class of exceptions involve semantic reasons, although the exact formulation of the semantic restriction is not clear. My informant rejected stress-shifted nominalizations of the verbs in (288), on the grounds that she could not assign any specific meaning to them.

(288)
rebind
rename
repot
reseat
re-sign
retell
reword

In later elicitations, I have asked two informants (including the original informant who at first rejected the forms in (288)) to imagine a context like: "this didn't work too well, we're going to have to do a …" where a nominalized verb can be inserted. Both informants could use *re*-verb nominalizations of all disyllabic stems, including those in (288), in this context. This shows that the restriction in (288) is indeed a semantic one, one that plagues much derivational morphology—derivational morphology is often only applicable if the resulting form has appropriate semantics, where appropriateness may be defined on the basis of such extralinguistic factors as nameworthiness, commonness, and so on.

In summary, stress-shifting nominalization is unproductive in general. It applies to a seemingly arbitrary class of verbs that do not share any semantic, morphological, or phonological properties. However, there is one class of verbs to which stress-shifting nominalization applies productively, namely disyllabic verbs containing the prefix *re*-. At this point, we must devise an account of this phenomenon. That is, we need a mechanism to let a morphological construction (here, stress-shifting nominalization) to recognize that the stem it applies to contains a specific morpheme (here, the prefix *re*-).

The fact that the nominalization construction needs to refer to the presence of a particular morpheme within the base it applies to may be thought to be evidence against Bracket Erasure. Indeed, Hammond 1991 calls this type of sensitivity to the presence of a specific morpheme in the stem "potentiation" (following Fabb 1988), and proposes to handle it via (criterial) morphemic circumscription. I will illustrate Hammond's account by considering one example, namely the English suffix *-ion*, which attaches freely to stems ending in the suffix -*ize* (among others). In Hammond's theory, the word *modernization* is derived as follows:

(289)	UR	modern	
	Suffixation	modernize	
	Circumscription	modern <ize>	(criterion satisfied: -*ize* present)
	Suffixation	modernization	

In order to recognize that the base ends in the appropriate suffix, we first detach the final morph of the base by morphemic circumscription. Recognizing this suffix as -*ize*, we know that we may attach -*ion*. We reattach -*ize*, and then attach -*ion*. Obviously, this account requires referring to internal morphological structure, and is therefore inconsistent with Bracket Erasure. Let us see how we would use criterial morphemic circumscription to deal with *re*- verb nominalization:

(290)	UR	fill	
	Prefixation	refill	
	Morphemic circumscription	<re> fill	(criterion satisfied: *re*- present)
	Stress-shifting nominalization	réfill	

These facts pose an apparent challenge to Sign-Based Morphology, which is committed to a strict view of Bracket Erasure effects by virtue of its architecture. I will turn in a moment to ways of dealing with this apparent problem. But first, I will show that the morphemic circumscription account is itself subject to serious problems. Like criterial prosodic circumscription (McCarthy and Prince 1986, 1990, 1994a,b), criterial morphemic circumscription should be expected to target material at the edge where the affix in question is attached. That is, a suffix circumscribes material at the end of the stem, while a prefix circumscribes material at the beginning.[52] Although not much has been said about this point, it is clear that such a restriction holds on criterial prosodic circumscription. Thus, we often find cases of prefix allomorphy sensitive to the initial segment of the base, and of suffix allomorphy sensitive to the final segment of the base. A good example if the Turkish passive suffix: the allomorph -*(I)n* is used on vowel and [l]-final roots, while -*Il* is used elsewhere (291):

52 This differs from positive and negative circumscription, where, for example, a foot may be circumscribed at the left edge and a suffix attached to this foot.

(291)	tekʲmelʲe-n	‘kick-pass’
	budɑ-n	‘prune-pass’
	jykʲselʲ-in	‘raise-pass’
	kɑl-ɯn	‘stay-pass’
	døn-ylʲ	‘turn-pass’
	bɑk-ɯl	‘look-pass’
	dolɑʃ-ɯl	‘wander-pass’
	bedʒer-ilʲ	‘manage-pass’

This very common type of allomorphy can be accounted for by using criterial prosodic circumscription: the passive suffix circumscribes the last segment in order to decide on which allomorph to use, then attaches to the whole stem (thus positive or negative circumscription would not be appropriate). If criterial prosodic circumscription is not restricted to the edge of attachment, we predict cases of prefixal allomorphy sensitive to the final segment of the base, and of suffixal allomorphy sensitive to the initial segment of the base. Since such flagrant violations of locality are not found in languages, criterial circumscription must be restricted to the edge of attachment.

Thus, if morphemic circumscription is the right way to deal with potentiation, we should not find cases where a prefix is potentiated by a suffix (that is, it may attach only to bases that contain that suffix), or a suffix potentiated by a prefix. Unfortunately for the theory of morphemic circumscription, there is a convincing case of a suffix potentiating a prefix in English. The prefix *un-* attaches only to some adjectives:

(292)	uncommon	*ungood
	unhappy	*unpretty

However, *un-* will attach to any adjectival participle derived from a verb by the suffix *-ed* (or *-en*):[53]

(293)	undeserved	unmodified	unprecedented
	untried	unobserved	untied
	unmentioned	unreinforced	unpainted

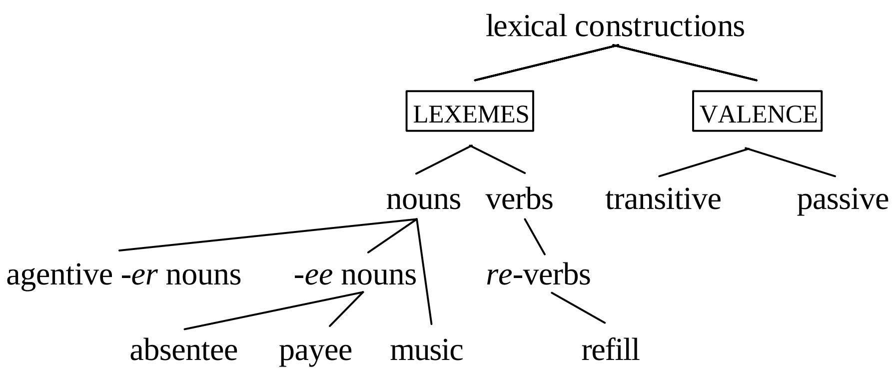
This shows that edgemostness is not the relevant criterion for potentiation. Rather, one needs to refer to the outermost morpheme in terms of constituent structure. This could be a prefix, suffix, or an infix (or, for that matter, even a nonaffixational morphological construction such as compounding, reduplication, zero derivation, truncation, etc.). Thus, “morphemic circumscription” is not a matter of linear order, but rather one of hierarchical

53 It is possible that an account of this based on lexical semantics may be formulated. The general point remains valid, however. The example involving potentiation of -ment by -en can also be used to illustrate the same point, since it is another case of wrong-edge circumscription.

constituent structure. The morpheme that needs to be identified is the outermost one in the constituent structure, regardless of whether it is a prefix or a suffix.

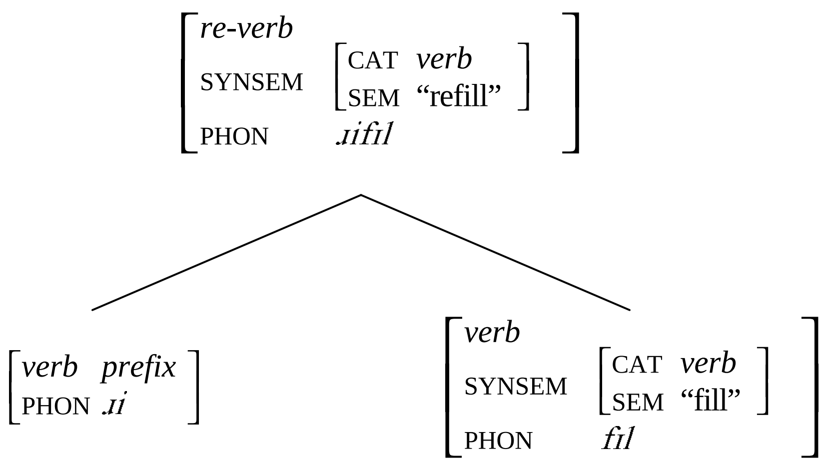
Recall from section 5.2.3 that each morphological construction defines a particular type in the lexical type hierarchy. Affixation constructions are of course also part of the type hierarchy. In (294), I repeat Koenig and Jurafsky 1994's type hierarchy, but include the type *re-verb* as well (and omit some irrelevant information):

(294)



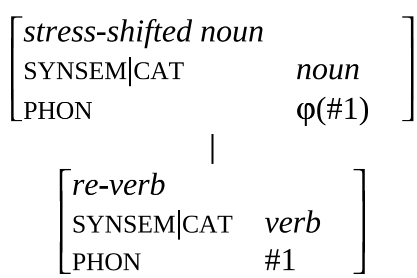
A simplified constituent structure for the verb *refill* is given in (295):

(295)



I propose that the productive stress-shifting nominalization construction specifies its stem daughter to be a *re-verb*, rather than the more general type *verb*. Thus, the construction looks something like (296):

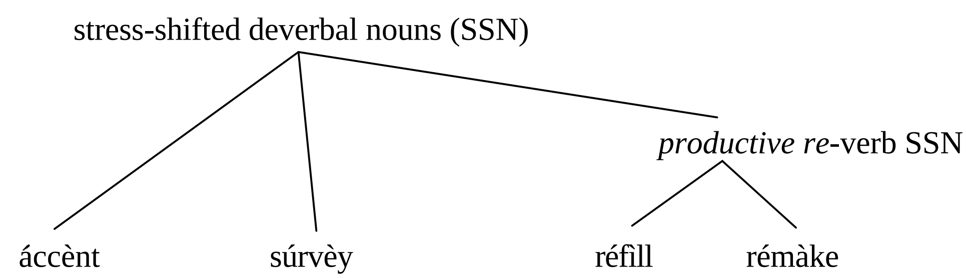
(296)



The content of φ has been described in section 5.4. Like all morphological constructions, the stress-shifting nominalization construction makes reference to the type of its daughter. This type reference is sufficient to uniquely identify the outermost (in terms of constituent structure, not linear order) morphological construction that has applied to the daughter. Since the daughter is an affixed stem, this reference amounts to identifying the outermost affix in the stem. For the other cases of potentiation described in this section, a similar account is possible (for example, the construction that adds the prefix *un-* to adjectives will specify its daughter to be a participial adjective by referring to this lexical type). This account has two advantages over morphemic circumscription: first, it is more restrictive. Morphemic circumscription requires abandoning Bracket Erasure and identifying a subpart of the phonological string as a morph. This makes the locations of morph boundaries available. Yet, all we need to deal with potentiation is to know that a particular morpheme is present in a stem. There is never any need to refer to the location of that morpheme within the stem. Sign-Based Morphology makes just the right amount of information available: the identity of the outermost morpheme is available through reference to the lexical type of the stem. The location of the morpheme is not available, since phonological strings do not carry any morphological breakdown information (this function being taken over entirely by the constituent structure skeleton). The second advantage Sign-Based Morphology offers is that it can identify nonaffixational morphological constructions such as compounding, which circumscription cannot do. We will see examples where reference to nonaffixational constructions is needed in sections 5.5.3 and 5.5.4.

I close this section with a discussion of how to treat unproductive stress-shifted nominals of verbs that do not contain the prefix *re-* (283). Using Koenig and Jurafsky 's (1994) "open world" interpretation,[54] we list all unproductive stress shifted nominals under the type *stress shifted deverbal noun (SSN)*. It is understood that such listing closes the branch; thus this type cannot be used on-line to create new forms. A separate subtype of the type *SSN* is the productive *re*-verb nominalization construction.

(297)



No actual words are listed under the productive *re*-verb nominalization construction, which is used on-line for creating or processing novel *re*-verb nominals.

54 The advantage of this interpretation is its simplicity—it is consistent with Carpenter's (1992) axiomatization of type hierarchies. Other possible choices are Riehemann's (1994) open world interpretation, or nonmonotonic inheritance with defaults.

5.4 Phonological analysis of *re*-verb nominalization

The main purpose of this section is to develop a phonological analysis that accounts for the fact that stress-shifting nominalization applies successfully to disyllabic verbs, but fails to apply to longer verbs. The main insight is that ungrammaticality results from two incompatible conditions: first, stress-shifted nominals must have a characteristic stress pattern: initial primary stress and peninitial secondary stress (*rédò*). Second, stress clash is not allowed in forms that contain more than two syllables (in disyllabic forms, stress clash is unavoidable since there are as many stresses as there are syllables).

The phonological restriction to disyllabicity presumably has to do with the foot assignment to stress-shifted nominals (Orgun 1995c, Orgun and Sprouse 1996b). A disyllabic stress-shifted nominal has two monosyllabic feet adjacent to each other (298):

```
(298)            F  F
                 /\ /\
                 re do
```

When we attempt to apply stress-shifting nominalization to verbs containing more than two syllables there is no grammatical output. We need to consider two patterns. In the first pattern, the input verb has stress on the syllable immediately following the prefix *re*- (that is, the root initial syllable). In the second pattern, the input verb does not have stress on the root initial syllable, but rather on a syllable further to the right. In this case, the output form has primary stress on *re*-, while secondary stress is placed on the syllable that bears stress in the input verb in my informant's attempts at pronouncing the ungrammatical forms. In other words, the secondary stress does not shift to its required location (immediately following *re*-) (299):

(299)	*réunìte	(not *réùnite*)
	*réemplòy	(not *réèmploy*)
	*récommìt	(not *récòmmit*)

Whether or not any linguistic significance can be attached to attempted rendering by informants of ungrammatical forms, the data in (299) suggest an analysis couched within Optimality Theory (Prince and Smolensky 1993). In Optimality Theory, a grammar is modeled by a set of ranked and violable constraints. Among an infinite set of candidate outputs, the one that incurs the fewest violations of higher-ranking constraints is picked as the actual output, even if it violates more lower-ranked constraints than competing candidate forms. Handling ungrammaticality in this model is a bit of a challenge—it would appear that Eval, the constraint system, will always pick a winner. Prince and Smolensky 1993 propose that there is a special candidate called the null parse. This candidate is stipulated to violate no constraint except for a new one they propose, MPARSE, which no other candidate violates. Now, ranking a phonological constraint C above MPARSE amounts to declaring C to be inviolable: the null parse is better than any candidate that violates C. If violation of C cannot be avoided, then the null parse emerges as the winner. In other words, there is no grammatical output.

For the English *re*-verb problem, the inviolable constraints responsible for ungrammaticality are the ones that require the special stress patterns of stress-shifted nominals. Here, I will take an informal, convenient approach to constraint descriptions. It should be kept in mind that whatever phonological analysis of the facts is favored, the general points regarding the architecture of grammar will be intact.

The first inviolable constraint is one that Prince and Smolensky 1993 have proposed, LEX≈PR, which requires every output form to contain a foot. The second is an alignment constraint (McCarthy and Prince 1993) that requires each output form to start with a stressed syllable. The third one is a constraint requiring for there to be a secondary stress (2nd Stress). The fourth constraint requires the secondary stress to be adjacent to the primary stress. The constraints are summarized in (300):[55]

(300)	LEX≈PR	The output must have a primary stress
	2ND STRESS	The output must have a secondary stress
	ALIGN PRIMARY	ALIGN(Word, L, Primary Stress, L) The first syllable of the output must bear the primary stress.
	ALIGN SECONDARY	ALIGN(Secondary Stress, L, Primary Stress, R) The secondary-stressed syllable must be adjacent to the primary-stressed syllable.

Since none of these constraints is ever violated by the output of the stress-shifting nominalization constraint, we may safely rank them all above MPARSE. Of course, talking about the relative ranking of inviolable constraints is meaningless, since the only evidence for ranking comes from conflict resolution, where the constraint that is violated by the winning candidate is ranked lower. In the case of inviolable constraints, conflict gives rise to ungrammaticality. No resolution is possible. Note therefore that Prince and Smolensky's innovation of MParse is nothing but a handy notation for declaring some constraints to be inviolable. If the constraints in (300) were all the grammar had, then a stress-shifted output would be possible for polysyllabic *re*-verbs (for example, **réùnite* satisfies all the constraints in (300)). The fact that this is impossible suggests that there is yet another inviolable constraint at work. This constraint prevents the input stressed syllable to be destressed to allow the root initial syllable to bear secondary stress. Such a constraint has been used by McCarthy (1995), who calls it HEAD-IDENT (301).

(301) HEAD-IDENT A syllable that is stressed in the input must be stressed in the output as well.

55 Orgun and Sprouse (1996a,b) propose a more elegant analysis of this phenomenon: they argue that re-verbs contain two phonological words, and that each phonological word must have initial stress. Although this analysis is elegant, it does not extend to the general stress-shifted nominalization construction that licenses, for example, *ádrèss*. The more direct analysis here handles all stress-shifted nouns.

In the tableau in (302), the constraints LEX≈PR and ALIGN-PRIMARY are not shown, since none of the candidates that violate them are of interest to us.

(302)

	2ND STRESS	HEAD-IDENT	ALIGN-2ND	MPARSE
☞ rédò				
rédo	*!			
∅				*!

	2ND STRESS	HEAD-IDENT	ALIGN-2ND	MPARSE
réùnite		*!		
réunìte			!*	
réunite	*!			
☞ ∅				*

This account works well for *re*-verbs that have stress later than the second syllable. But how about those that are stressed on the root initial syllable? For those, there is a candidate that satisfies all the constraints we have so far. For example, *révìvify* satisfies all our constraints. It seems that clash avoidance is at work in these cases. We might therefore try adding *CLASH as another inviolable constraint to our grammar to rule out these forms. However, this move will not work, since it will incorrectly rule out grammatical stress-shifted nominalizations of disyllabic *re*-verbs (such as *réfill*), which show that *CLASH must be ranked below MPARSE. Orgun and Sprouse (1996a,b) contend that this is a general problem with MPARSE—there are cases where violation of a constraint known to be violable in the language could have led to a grammatical output, but such violation is nonetheless avoided and no grammatical output is possible.[56] Their proposal is to move all inviolable constraints to a new constraint system called CONTROL. Grammatical output forms must satisfy two conditions: first, they have to be the optimal output picked by EVAL, and, second, they must satisfy all constraints in CONTROL. For the *re*-verb problem, it suffices to assign ALIGN-2ND to CONTROL, and rank *CLASH above HEAD-IDENT. MPARSE is not used in this model. The winning outputs for the three input forms *redo*, *reunite*, and *revivify* picked by EVAL are shown in (303) (the null parse is no longer included in the candidate set):

(303)

EVAL	2ND STRESS	*CLASH	HEAD IDENT
☞ rédò		*	
rédo	*!		*

56 The problem posed to MParse by the English stress shifting nominalization construction is quite similar to the problem posed by Turkish minimality in section 2.3. In both cases, repair would be possible by violating a constraint known to be violable in the language. However, ungrammaticality rather than repair is still the result.

EVAL		2ND STRESS	*CLASH	HEAD IDENT
☞	réunìte			
	rèùnite		*!	*
	réunite	*!		*

EVAL		2ND STRESS	*CLASH	HEAD IDENT
	révivifỳ		*!	
☞	révivifỳ			*
	révivify	*!		*

These winners must be checked against the inviolable constraint component, CONTROL. This is done in (304):

(304)

CONTROL		ALIGN-2ND
✓	rédò	
✂	réunìte	*!
✂	révivifỳ	*!

To sum up the discussion so far, stress-shifting nominalization applies productively to verbs containing the prefix *re-*. Even though there are a large number of polysyllabic verbs that do not undergo stress-shifting nominalization, this is for purely phonological reasons, and therefore casts no doubt on the productivity of the construction.

5.5 Cophonological allomorphy

In this section, I have two goals. The first is to motivate the concept of cophonologies by showing that there is a special type of allomorphy that I call cophonological allomorphy. Most cases of allomorphy are such that the various allomorphs of a morpheme contribute different phonological material. In cophonological allomorphy, the allomorphs have exactly the same underlying phonological shape, but they trigger different morphophonemic alternations, or impose different phonological constraints. My second aim in this section is to show that there are cases of cophonological allomorphy in which crucial reference to the lexical type of the input stem is needed. Some of these cases have been (Japanese, section 5.5.1) or can be (Turkish, section 5.5.3) seen as counterexamples to Bracket Erasure. I show that in these cases, just as in the English case, the correct approach is to make reference to the lexical type, not to morph boundaries, because all that is needed is to recognize the existence of a morpheme within the stem, but no reference is ever made to the location of the morpheme.

5.5.1 Japanese deverbal noun accentuation

Japanese deverbal noun accentuation has been claimed to be a counterexample to Bracket Erasure (Poser 1984). In this section, I show that reference to lexical types is all that is needed to deal with the data, as it is necessary to identify compound verbs, but the location of the compound boundary is never referred to. Furthermore, the data in this section cannot be handled by morphemic circumscription, and thus provide an empirical argument in favor of Sign-Based Morphology.

I start with a description of accentuation of deverbal nouns formed out of noncompound verbs. If the verb is accentless, so is the deverbal noun, as shown in (305):

(305) Accentless verb (infinitive) / Deverbal noun (no accent)

kari-ru	'borrow'	kari
nagusam-u	'be diverted by'	nagusami
utaga-u	'doubt'	utagai

If the verb is accented, then so is the deverbal noun. However, the deverbal noun bears a final accent regardless of the location of the verb's accent (306):

(306) Accented verb (infinitive) / Deverbal noun (final accent)

haji'-ru	'be ashamed'	haji'	'shame'
hira'k-u	'open'	hiraki'	'closet'
i'r-u	'parch'	iri'	

I now present a rough Optimality Theoretic analysis of this behavior. The analysis is presented just for illustrative purposes. Even if a different analysis is adopted, the main points of this section will remain valid.

We need some faithfulness constraints ruling out insertion and deletion of accents (DEP-accent and MAX-accent, respectively), and requiring the accent to fall on the same syllable in the output as it does in the input (ACC-LOC). This last constraint can be seen as a kind of "head-identity" constraint (McCarthy 1996a) which requires the correspondent of an accented syllable to be accented, and the correspondent of an accentless syllable to be accentless. We also need an alignment constraint that requires any accent in the output to be final. The constraints for deverbal noun formation are summarized in (307):

(307)

MAX-accent	Every input accent must correspond to an output accent.
DEP-accent	Every output accent must correspond to an input accent.
ACC-LOC	An accented input syllable must correspond to an accented output syllable. An accentless input syllable must correspond to an accentless output syllable.
ALIGN(accent, R, word, R)	The accent (if any) in the output must be final

Of these constraints, ALIGN and MAX must dominate ACC-LOC. No other ranking is motivated by the data. The tableaux in (308) show how these constraints account for the data (DEP is not shown in the tableaux; it is never violated):

(308)

/kɑri/	MAX-accent	ALIGN	ACC-LOC
☞ kɑri			

/i'ri/	MAX-accent	ALIGN	ACC-LOC
iri	*!		*
i'ri		*!	
☞ iri'			**

I will refer to this particular constraint ranking as φ_1 in constructions.

In contrast with what we have just seen, deverbal nouns formed out of compound verbs are never accented, even when the compound verb itself is accented (309):

(309)

Compound verb (infinitive)		Deverbal noun (no accent)
hiki-ɑge'ru	'pull up'	hikiɑge
ii-ɑ'u	'quarrel'	iiɑi
oki-kɑe'ru	'replace'	okikɑeri

Poser argues that there is an accentuation rule that mentions the compound boundary in its environment. This requires the compound boundary to be visible to the phonology, a violation of Bracket Erasure. We would like to develop an alternative analysis to preserve our strict approach to Bracket Erasure effects. Note that, quite independently of our desire for a restrictive theory, there is good motivation to look for an alternative analysis: a rule that deletes an accent when there is a morpheme boundary anywhere in the form is highly unnatural, and is inconsistent with any locality conditions that one might want to impose on phonological rules (Poser 1982, Odden 1994).

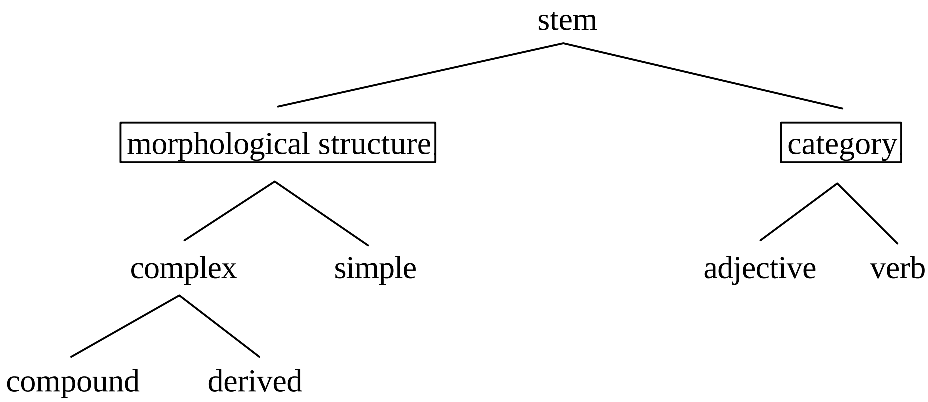
The cophonology enforcing accent deletion will have a high-ranking constraint NO-ACCENT. I show no tableaux to illustrate this cophonology, since it is very straightforward: NO-ACCENT ranks higher than MAX, forcing any input accent to be deleted. I will call this cophonology φ_2.

The solution I propose to Poser's problem involves reference to lexical types. Any grammar that has a compounding construction must have a node in the type hierarchy that describes this construction. For example, the partial type hierarchy that Riehemann 1994 proposes for German includes the types *compound* and *derived*,[57] as shown in the diagram in (310):

---

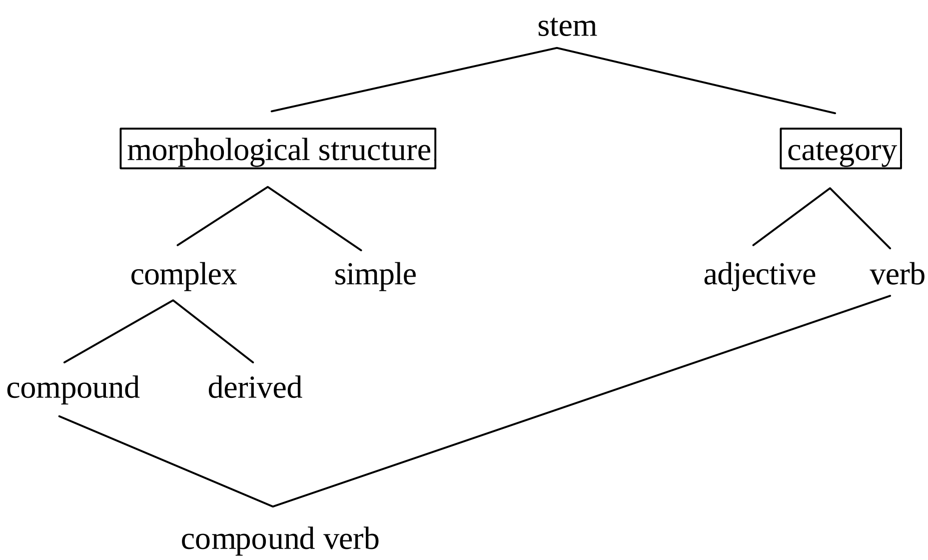
57 The type derived is intended to include affixed forms as well as those derived by nonconcatenative morphology such as zero derivation, reduplication, and truncation. There will be a subtype for each of these kinds of derivation, of course.

(310)



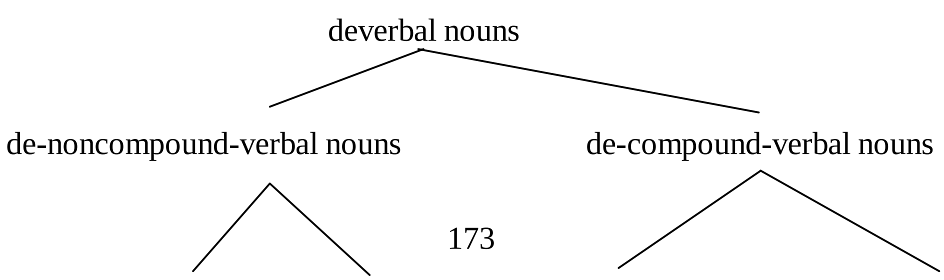
The lexical type hierarchy for Japanese will also contain similar types. The type that we need to refer to is *compound verb*, shown in (311) to inherit from the types *compound* and *verb*:

(311)



The Japanese deverbal noun construction has two "alloconstructions" (I would have called them allomorphs, but since we are not dealing with a morpheme, but rather a construction, I use the term alloconstruction). The general construction is called *deverbal noun*. This construction does not specify the phonological mapping. It has two subtypes, which are the two alloconstructions. One of these alloconstructions applies to noncompound verbs and subscribes to φ_1. The other alloconstruction, which applies to compound verbs subscribes to φ_2, the accent deleting cophonology (312).

(312)



kɑri iru’ hikiɑge iiɑe

The description of the type *deverbal noun* is shown in (313):

(313)

$$\begin{bmatrix} \textit{de-noncompound-verbal noun} & \\ \text{SYNSEM}|\text{CAT} & \textit{noun} \\ \text{PHON} & \varphi_1(\boxed{1}) \end{bmatrix}$$
$$|$$
$$\begin{bmatrix} \textit{verb} & \\ \text{SYNSEM}|\text{CAT} & \textit{verb} \\ \text{PHON} & \boxed{1} \end{bmatrix}$$

The structure of de-compound-verbal nouns is shown in (314)

(314)

$$\begin{bmatrix} \textit{deverbal noun} & \\ \text{SYNSEM}|\text{CAT} & \textit{noun} \\ \text{PHON} & \varphi_2(\boxed{1}) \end{bmatrix}$$
$$|$$
$$\begin{bmatrix} \textit{compound verb} & \\ \text{SYNSEM}|\text{CAT} & \textit{verb} \\ \text{PHON} & \boxed{1} \end{bmatrix}$$

We have seen that there is no Bracket Erasure problem in Japanese deverbal noun accentuation. All we need to refer to is the lexical type of the input verb. The lexical type is available and needed for constructing the type hierarchy independently of Bracket Erasure effects. No additional ad-hoc tools or mechanisms are necessary.

Note also that morphemic circumscription cannot deal with Japanese deverbal noun accentuation. If we circumscribe a morpheme, we end up with a regular stem, which should be subject to the usual accentuation rules. This is the wrong result. Thus, we have seen that Sign-Based Morphology is not only more principled that morphemic circumscription in that it makes less information available, it also possesses the required descriptive flexibility that morphemic circumscription lacks.

5.5.2 Breton mutation

The second example of cophonological allomorphy comes from Breton, and involves the definite article *ar*, which I will treat as a clitic. The data come from Press 1986 and Stump 1988. When *ar* is added to feminine singular or masculine plural human nouns, mutation applies. In all other cases, mutation does not apply. Example (315) shows the alternations imposed by mutation.

(315)

p	t	k	b	d	g	gw	m
↓	↓	↓	↓	↓	↓	↓	↓
b	d	g	v	z	x	w	v

In (316), we see lenition applying to feminine singular and masculine plural human nouns, while in (317), lenition fails to apply.

(316)	a)	ɑr vɑg	'the boat (fem sg)'	(bɑg)
	b)	ɑr bɑotred	'the boys (masc pl human)'	(pɑotred)
	c)	ɑr vrex	'the arm (fem sg)'	(brex)
	d)	ɑr werenn	'the glass' (fem sg)'	(gwerenn)

(317)	a)	ɑr bɑgu	'the boats (fem pl)'	(bɑgu)
	b)	ɑr pɑotr	'the boy (masc sg)	(pɑotr)
	c)	ɑr penn	'the head (masc pl non-hum)'	(penn)

In an SPE-like framework, lenition might be expressed as a morphologically conditioned phonological rule, along the lines of (318):

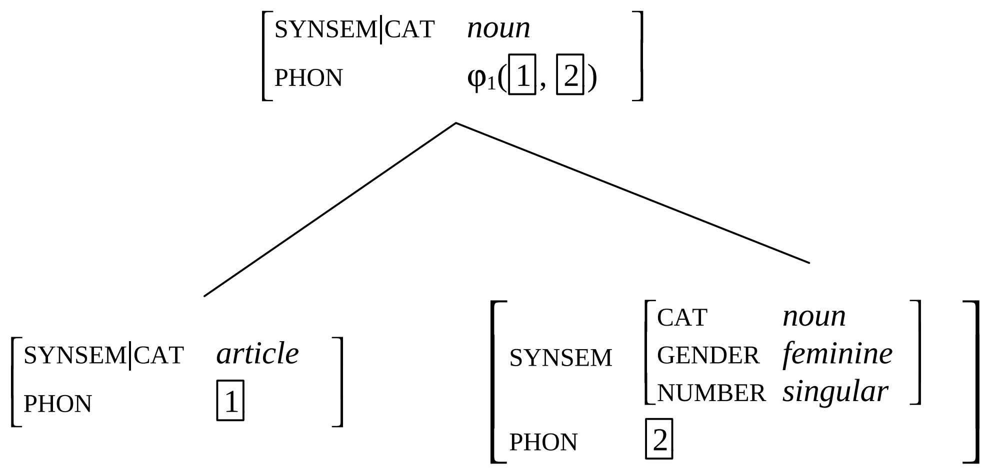
(318)

$$\left\{\begin{matrix} p\\ t\\ k\\ b\\ d\\ g\\ gw\\ m \end{matrix}\right\} \rightarrow \left\{\begin{matrix} b\\ d\\ g\\ v\\ z\\ x\\ w\\ v \end{matrix}\right\} \Bigg/ \ \text{[article]} \quad \# \quad \underset{\left\{\begin{matrix}\begin{bmatrix}\text{feminine}\\ \text{singular}\end{bmatrix}\\ \begin{bmatrix}\text{masculine}\\ \text{plural}\\ \text{human}\end{bmatrix}\end{matrix}\right\}}{\underline{\qquad\qquad\qquad}}$$

In a framework such as Sign-Based Morphology that uses cophonologies, we would like to eliminate diacritic reference by specific phonological rules (or constraints) to morphosyntactic and semantic features. Otherwise, we would have two distinct ways of letting morphology influence phonology, an undesirable situation. It would be a more parsimonious view to require all phonological constraints to be stated in terms of strictly phonological information. The only way morphology can influence phonology is by selecting a particular cophonology for a particular morphological construction.

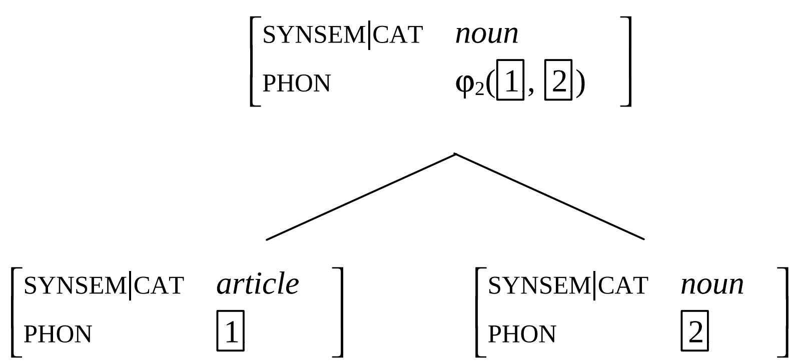
The Breton problem does not pose any challenges to Bracket Erasure. Neither is reference to lexical types crucial. The different allomorphs of the definite article clitic *ar* need to refer to some morphosyntactic or semantic features of the stem they attach to. I will not formulate a phonological analysis of mutation, since the issue is rather complicated and not germane to the topic of this work (see Gahl 1995, Grijzenhout 1995). In (319), I show one allomorph of *ar*, the one that applies to feminine singular nouns and subscribes to the mutation cophonology, φ_1.

(319)



The general, nonmutating allomorph is shown in (320):

(320) Other cases: lenition does not apply



As usual, we would need to set up two subtypes of the *ar* construction, each subscribing to a different cophonology.

5.5.3 Turkish place name stress

In this section, we will see a case of cophonological allomorphy in nonconcatenative morphology. The construction of interest forms place names out of any word in Turkish, already discussed at some length in section 4.7.3, where I examined the implications of Sezer stress for level ordering. In this section, we are interested in the choice between Sezer and non-Sezer stress in place names. Stress is normally final in Turkish. However, as Sezer (1981) has shown, place name formation imposes a distinct nonfinal stress pattern. As illustrated in (321), the final syllable is ignored, and stress falls on the antepenultimate syllable if the penult is light and the antepenult is heavy. In all other cases, stress falls on the penultimate syllable. Following Inkelas and Orgun 1995, I call this stress pattern Sezer stress, after its discoverer.

(321) HH́σ is.tɑ́n.bul, ɑn.tɑ́lʲ.jɑ, hɑkʲ.kʲɑ́ː.ri, ɯs.pɑ́r.tɑ
ḢLσ ɑ́n.kɑ.rɑ, mér.dʒi.mekʲ, bólʲ.vɑ.din, mén.te.ʃe
LH́σ e.dír.ne, hɑ.lʲi.kɑ́r.nɑs, mɑ.lɑ́z.gʲirt, tɑ.rɑ́b.jɑ
LĹσ ɑ.dɑ́.nɑ, fɑ.sé.lʲis, sy.mé.lʲɑ

As I demonstrated in section 4.7.3, Sezer stress is not a static regularity in the Turkish lexicon. Existing lexical entries (including morphologically complex ones) switch to the Sezer pattern when they are used as place names.

I now present a summary of Inkelas's (1994) analysis of the Sezer stress pattern. The main ingredients of the analysis are the following: a single trochaic foot is assigned at the right edge of a Sezer stem. A higher-ranking constraint against a heavy syllable followed by a stressed light syllable forces this foot to be placed one syllable to the left when the penult is light and the antepenult is heavy. The constraint that requires all feet to be trochaic is never violated, and will not be shown in the tableaux. Neither will LEX≈PR, the constraint requiring every stem to have a foot. The constraints that interest us are an alignment constraint that requires the foot to be at the right edge, and the higher-ranking CONTOUR constraint ($*\sigma_{\mu\mu}\acute{\sigma}_{\mu}$):

(322)

(322)	LEX≈PR	All Sezer stems must have a foot
	TROCHEE	Feet are trochaic
	ALIGN(Foot, R, Word, R)	All feet are at the right edge
	$*\sigma_{\mu\mu}\acute{\sigma}_{\mu}$	A heavy syllable may not be followed by a stressed light syllable

Ranking: $*\sigma_{\mu\mu}\acute{\sigma}_{\mu}$ » ALIGN(Foot, R, Word, R)

The tableau in (331) shows how this ranking accounts for Sezer stress:

(323)

/kɑndilʲlʲi/	$*\sigma_{\mu\mu}\acute{\sigma}_{\mu}$	ALIGN
kɑ́ndilʲlʲi		*!
☞ kɑndílʲlʲi		

/kʲestɑːnelʲikʲ/	$*\sigma_{\mu\mu}\acute{\sigma}_{\mu}$	ALIGN
kʲéstɑːnelʲikʲ		**!
☞ kʲestɑ́ːnelʲikʲ		*
kʲestɑːnélʲikʲ	*!	

/ɑnkɑrɑ/	$*\sigma_{\mu\mu}\acute{\sigma}_{\mu}$	ALIGN
ɑnkɑ́rɑ	*!	*
☞ ɑ́nkɑrɑ		

/bɑʃɑrɑn/	$*\sigma_{\mu\mu}\acute{\sigma}_{\mu}$	ALIGN
bɑ́ʃɑrɑn		*!
☞ bɑʃɑ́rɑn		

I will refer to this cophonology as φ_S in constructions. The Sezer place name construction is depicted in (324):

(324)

[*Sezer place name*
SYNSEM|CAT *proper noun*
PHON $\varphi_S(\boxed{1})$]

|

[*stem*
SYNSEM *synsem*
PHON $\boxed{1}$]

As noted by Sezer 1981b, Inkelas and Orgun 1996, there is a class of stress-neutral place names that surface with default final word stress. Some are shown in (325):

(325) a) kɑtʃ-mɑ́z ‘escape-neg.imperf’
bekʲlʲe-méz ‘wait-neg.imperf’
søjlʲe-méz ‘say-neg.imperf. (=doesn’t say)’

b)	ɯʃɯk-lár	‘light-pl’
	sofu-lár	‘pious-pl’
	javaʃ-lár	‘slow-pl (=slow ones)’
	kuʃ-tʃu-lár	‘bird-profession-pl (=bird keepers)’
c)	kork-maz-lár	‘fear-neg.imperf-pl’
	dur-muʃ-lár	‘stop-past-pl (=they have stopped)’

The generalization that Sezer notes is that all place names formed out of words that end in the negative imperfective (325a), noun plural (325b), or plural subject agreement (325c) suffixes are always stress neutral. Thus, we have a cophonological allomorph of the place name construction, which I will call *nonSezer place name*, and which subscribes to φ_2, the stress-neutral cophonology. One subtype of this construction, the one that applies to plural nouns, is shown in (326):

(326)

$$\begin{bmatrix} \textit{nonSezer place name} & \\ \text{SYNSEM|CAT} & \textit{proper noun} \\ \text{PHON} & \varphi_2(\boxed{1}) \end{bmatrix}$$

$$|$$

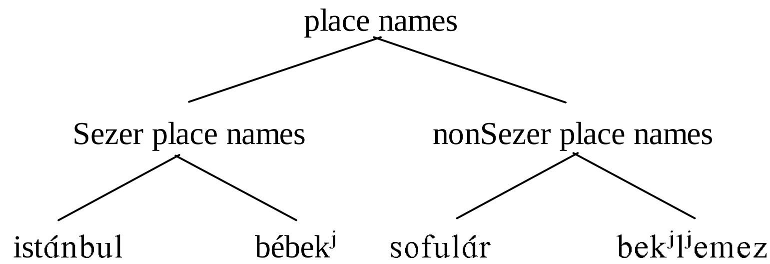
$$\begin{bmatrix} \textit{noun} & \\ \text{SYNSEM|NUM} & \textit{plural} \\ \text{PHON} & \boxed{1} \end{bmatrix}$$

I have formulated the nonSezer place name construction to refer to the feature SYNSEM|NUM *plural* rather than the lexical type *plural noun* (that is, refer to the class of nouns that have the plural morpheme as the outermost morpheme in their constituent structure), because plural nouns that have further suffixes following the plural also form stress-neutral place names (I have not found any real place names that shows this; the data in (327) reflect my own judgments of made up names):

(327)	<u>word</u>		<u>used as place name</u>
	kuʃtʃu-lar-á	‘bird-agt-pl-dat’	kuʃtʃu-lar-á
	sofu-lar-dán	‘pious-pl-abl’	sofu-lar-dán

The part of the lexical type hierarchy that includes place names is shown in (328):

(328)



There is one neutral-stressed monomorphemic place name reported by Sezer 1981b: *anadolú*. We can handle this in our type hierarchy by listing *anadolú* as a subtype of *nonSezer place names*.

In this section, we have seen that cophonological allomorphy is applicable to nonconcatenative morphology. Place name formation, a regular morphological process in Turkish, has two cophonological allomorphs, one that assigns Sezer stress, and one that is stress-neutral. Reference to lexical types was not necessary to deal with the cophonological allomorphy of place name formation. However, the type hierarchy was useful in handling a positive exception to the stress-neutral allomorph, namely Anadolu, a place name that does not meet the morphosyntactic criteria for the stress-neutral allomorph, but nonetheless is subject to it.

5.5.4 Ulwa possessives

The example in this section involves a morpheme that is infixed into some roots and suffixed to others. The example comes from Ulwa, previously described and analyzed by Sezer 1981b, Bromberger and Halle 1989, Hale and Blanco 1989, McCarthy and Prince 1995. The possessive morpheme, underlined in (329), is infixed into most roots:

(329)	siwɑnɑk	siwɑ<u>kɑ</u>nɑk	'root'
	kululuk	kulu<u>kɑ</u>luk	'woodpecker'
	ɑnɑːlɑːkɑ	ɑnɑː<u>kɑ</u>lɑːkɑ	'chin'
	ɑrɑkbus	ɑrɑk<u>kɑ</u>bus	'gun'
	kɑrɑsmɑk	kɑrɑs<u>kɑ</u>mɑk	'knee'

I present a rough analysis of Ulwa infixation in McCarthy and Prince's (1993) Generalized Alignment framework (see McCarthy and Prince 1993 for a detailed discussion). Following McCarthy, I assume two alignment constraints, one that requires *ka* to be a prefix (that is, aligned at the left edge), and another, higher-ranking one that requires *ka* to follow a foot.[58]

58 It is also possible to assume a constraint requiring ka to be suffix, and another that requires it to immediately follow a foot. Then, assuming only one foot at the left edge of each word is formed, the same infixation pattern follows. The choice of analysis will depend on which foot assignment is motivated in Ulwa based on independent factors. I do not know of evidence pointing either way.

(330) ALIGN(*ka*, L, Word, L) *ka* must be at the left edge
ALIGN(*ka*, L, Foot, R) *ka* must follow a foot

Ranking: ALIGN-FT » ALIGN-L

The tableau in (331) shows how these constraints derive infixation (ALIGN-L violations are measured in terms of syllables, though as McCarthy and Prince (1993) point out, it does not matter what measure is used; all we need is to be able to compare violations by pairs of candidates. Notice also that I have assumed iambic feet, but nothing depends on this assumption either, as long as every word starts with a disyllabic foot). I will refer to the ranking in (331) as φ_1.

(331)

/kɑ-ɑnɑːlɑːkɑ/	ALIGN-FT	ALIGN-L
kɑɑnɑːlɑːkɑ	*!	
☞ ɑnɑːkɑlɑːkɑ		**
ɑnɑːlɑːkɑkɑ		***!

Although the possessive morpheme is normally an infix, there is a lexically arbitrary class of nouns that take the possessive morpheme as a simple suffix (332):

(332)

gobɑment	gobɑment-kɑ	'government'
ɑbɑnɑ	ɑbɑnɑ-kɑ	'dance'
bɑssirih	bɑssirih-kɑ	'falcon'
ispiriŋ	ispiriŋ-kɑ	'elbow'

I will call the cophonology for this suffixing allomorph φ_2. If it is considered important that φ_1 and φ_2 should be minimally distinct, φ_2 may be formulated simply by adding a higher-ranking morpheme integrity (Spencer 1994) constraint that prevents infixation. Suffixation is then forced by ALIGN-FT.[59] Since the classes of lexical items that take the infixing versus suffixing allomorphs of the possessive morpheme are arbitrary, we must posit two inflectional classes in our lexical type hierarchy. I will simply label these *class 1* and *class 2*. Each noun root belongs to one of these two classes. The two subtypes of the possessive construction specify these two classes as the type of their morphological daughter. These two constructions are shown in (333):

59 Assuming exhaustive footing.

(333) Infixing allomorph / Suffixing allomorph

$$\left[\begin{array}{ll}\textit{class 1 possessed noun} & \\ \text{SYNSEM|CAT} & \textit{noun} \\ \text{PHON} & \varphi_1(\boxed{1}, \textit{ka})\end{array}\right] \qquad \left[\begin{array}{ll}\textit{class 2 possessed noun} & \\ \text{SYNSEM|CAT} & \textit{noun} \\ \text{PHON} & \varphi_2(\boxed{1}, \textit{ka})\end{array}\right]$$

$$\left[\begin{array}{ll}\textit{class 1 noun} & \\ \text{SYNSEM|CAT} & \textit{noun} \\ \text{PHON} & \boxed{1}\end{array}\right] \qquad \left[\begin{array}{ll}\textit{class 2 noun} & \\ \text{SYNSEM|CAT} & \textit{noun} \\ \text{PHON} & \boxed{1}\end{array}\right]$$

In this section, I have shown how reference to lexical types solves some long-standing Bracket Erasure problems. Sign-Based Morphology's account of these phenomena is superior to past proposals to abandon Bracket Erasure (Poser 1984, Hammond 1991), because it makes just the right amount of information about internal morphological information available to the grammar. Abandoning Bracket Erasure would make too much information available. In particular, Sign-Based Morphology allows access to the identity of the outermost morphological construction (in terms of constituent structure) in a form, but not the location of the morphological boundaries associated with that construction. I have also motivated cophonological allomorphy, that is, allomorphy in which the allomorphs have identical underlying forms, and differ solely in terms of the morphophonemic alternations they trigger. We have seen cases of reference to lexical type without cophonological allomorphy (English, section 5.3), cophonological allomorphy without reference to lexical types (Breton, section 5.5.2 and Turkish, section 5.5.3), and a case of cophonological allomorphy sensitive to lexical types (Japanese, section 5.5.1).

5.6 Cyclic effects in Cibemba

In this section, I consider apparent cyclic phonology and "interfixation" in Cibemba (Hyman 1994) from the perspective of Sign-Based Morphology's strict predictions regarding Bracket Erasure effects. The analysis will utilize analytical tools motivated in the preceding sections, namely, cophonological allomorphy and reference to lexical types.

5.6.1 Data

The basic phonological alternation we are concerned with is mutation of consonants by the causative suffix, which Hyman symbolizes as /į/.[60] Before this suffix, labials change to [f] and nonlabials change to [s] (334). Nasals do not undergo mutation.

60 The causative suffix contains the reflex of the proto-Bantu superclosed vowel [į], which has been phonetically neutralized with regular [i] in Cibemba.

(334)	Verb root		Causative	
	-leːp-	‘be long’	-leːf-i̧-	‘lengthen’
	-up-	‘marry’	-uf-i̧-	‘marry off’
	-lub-	‘be lost’	-luf-i̧-	‘lose’
	-lob-	‘be extinct’	-lof-i̧-	‘exterminate’
	-fiit-	‘be dark’	-fiis-i̧	‘darken’
	-ónd-	‘be slim’	-óns-i̧-	‘make slim’
	-buːk-	‘get up’	-buːs-i̧-	‘get (someone) up’
	-lúng-	‘hunt’	-lúns-i̧-	‘make hunt’

As Hyman shows, when the causative and applicative suffixes are both present in a stem, mutation overapplies. Both the root-final consonant and the [l] of the applicative *-il* undergo mutation, although only the latter is followed by [i̧] in the surface form (335):

(335)	Applicative		Applicative-causative
	-leːp-el-	‘be long for~at’	-leːf-es-i̧-
	-up-il-	‘marry for~at’	-uf-is-i̧-
	-lub-il-	‘be lost for~at’	-luf-is-i̧-
	-lob-el-	‘be extinct for~at’	-lof-es-i̧-
	-fiit-il-	‘be dark for~at’	-fiis-is-i̧-
	-ɔ́nd-el-	‘be slim for~at’	-ɔ́ns-es-i̧-
	-lil-il-	‘cry for~at’	-lis-is-i̧-
	-buːk-il-	‘get up for~at’	-buːs-is-i̧-
	-lúng-il-	‘hunt for~at’	-lúns-is-i̧-

It might be thought that mutation applies iteratively from right to left (that is, involves unbounded spreading of a feature [+s]) in (335). Hyman presents the following set of data show that this analysis is not viable. The data in (336) show that mutation only applies to root-final consonants, but never spreads into a root:

(336)					
	a)	-kɑ́lip-	‘be painful’	-kɑ́lif-i̧- *-sɑ́sif-i̧-	‘cause pain’
	b)	-polopoːk-	‘crackle’	-polopoːs-i̧- *-sosofoːs-i̧-	‘make crackle’
	c)	-pemekeːs-	‘pant’	-pemekeːs-i̧- *-pemeseːs-i̧-	‘make pant’

Likewise, the data in (337) show that mutation does not spread across the intransitive reversive suffix -*uk*, although this suffix itself undergoes mutation:

(337)

Verb	Intransitive reversive	Intransitive reversive - causative	
-kɑk-	-kɑk-uk-	-kɑk-us-į- *-kɑs-us-į-	'tie'
-ɑng-	-ɑng-uk-	-ɑng-us-į- *-ɑns-us-į-	'feel light'
-sup-	-sup-uk-	-sup-us-į- *-suf-us-į-	'be lively'

We have to conclude that mutation is local, affecting only the consonant that immediately precedes the superclosed vowel [į]. How then do we account for the double mutation in (335)?

5.6.2 Hyman's cyclic analysis

Hyman (1994) proposes an analysis of double mutation in Cibemba that uses Hammond's (1991) mechanism of morphemic circumscription. In his analysis, the causative suffix is attached first to the root, and causes mutation of the root-final consonant. When the applicative suffix is attached, the causative morph is detached by morphemic circumscription. The applicative then attaches to the root. Finally, the causative is attached back to the stem which now ends in the applicative suffix, and causes the final consonant of this suffix to mutate. This analysis is illustrated with an example in (338). Note that the order of attachment of these suffixes in Hyman's analysis agrees with their scope relation.

(338)

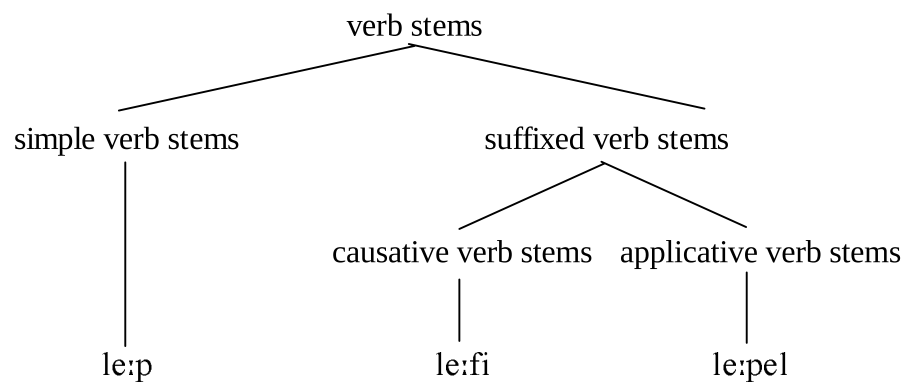
UR	Root	leːp
1st cycle	Affixation	[[leːp] į]
	Mutation	leːfį-
2nd cycle	Morphemic circumscription	[leːf] <į>
	Affixation	[[leːf] il] <į>
	Mutation	leːfesį-

This analysis requires identifying and detaching the vowel [į] as the causative morph within the stem's phonological material. This is an obvious violation of Bracket Erasure. In the next section, I will develop an alternative analysis of the data that does not require this relaxation of Bracket Erasure, and is, I will suggest, more elegant in that it makes use of crosslinguistically motivated properties of infixation.

5.6.3 Analysis based on cophonological allomorphy

In order to carry out Hyman's analysis based on morphemic circumscription, a stem needs to be identified as containing the causative suffix. We know that in Sign-Based Morphology such identification can be performed by referring to the lexical type *causative verb stem*, shown in the type hierarchy in (339):

(339)



In Hyman's analysis, identification of the verb stem as a causative one is done by detaching the rightmost morph and identifying it as the causative morph. The applicative is then suffixed to the remaining part of the stem (this is an example of negative morphemic circumscription in Hammond's terminology). We have just seen that in Sign-Based Morphology, a causative verb stem can be identified without detaching any morphs, by simply referring to the lexical type of the stem. Having identified the stem as causative, is it also possible to place the applicative suffix in the right location, that is, inside the final [į] without making reference to internal morph boundaries?

I claim that the applicative suffix has two cophonological allomorphs. One is an infix, and is added to causative verb stems.[61] The other is a simple suffix, and is added to other verb stems. This analysis takes advantage of the fact that the location of infixes tends to be predictable crosslinguistically on the basis of phonological wellformedness considerations, as shown by McCarthy and Prince 1993, McCarthy and Prince 1994a, McCarthy and Prince 1994b, McCarthy and Prince 1995. As McCarthy and Prince show, infixes are placed so as to avoid dispreferred syllable types (onsetless syllables and closed syllables). In the Cibemba case, infixing the applicative *-il* inside the vowel [į] avoids creating an onsetless syllable, or creating a long vowel by fusing the causative [į] with the [i] of the applicative [il].[62] Following McCarthy and Prince, I formulate an analysis of applicative infixation in the Generalized Alignment framework. An alignment constraint requires the applicative *-il* to be a suffix. A higher-ranking syllable structure constraint forces *-il* to be infixed. The constraints are shown in (340):

61 As Hyman shows, the same infixing allomorph is used with intensive stems as well, and the analysis presented here extends readily to those forms.

62 This would be the expected outcome if the applicative were to be added as a simple suffix, as vowel-vowel sequences undergo fusion creating a long vowel elsewhere in Cibemba.

(340) ALIGN(*il*, R, stem, R) Suffix -*il*
ONSET All syllables must have onsets
NLV No long vowel

Ranking: ONSET, NLV » ALIGN

The tableau in (341) shows how this ranking accomplishes infixation (vowel height harmony applies to the applicative suffix, but the constraint responsible for that is omitted since it is not relevant to the discussion):

(341)

/lufį - il/	ONSET	NLV	ALIGN
lufį.il	*!		
lufiːl		*!	
☞ lufisį			*

I will call this infixing constraint ranking φ_1. The other cophonological allomorph has a suffixing cophonology, which I will call φ_2, which can be modeled simply by ranking ALIGN above all conflicting phonotactic constraints. The two cophonological allomorphs are depicted in (342):

(342) Infixing allomorph of applicative: General applicative (suffixation)

[*applicative verb*
SYNSEM|CAT *verb*
PHON φ_1([1], *il*)]
|
[*causative verb*
SYNSEM|CAT *verb*
PHON [1]]

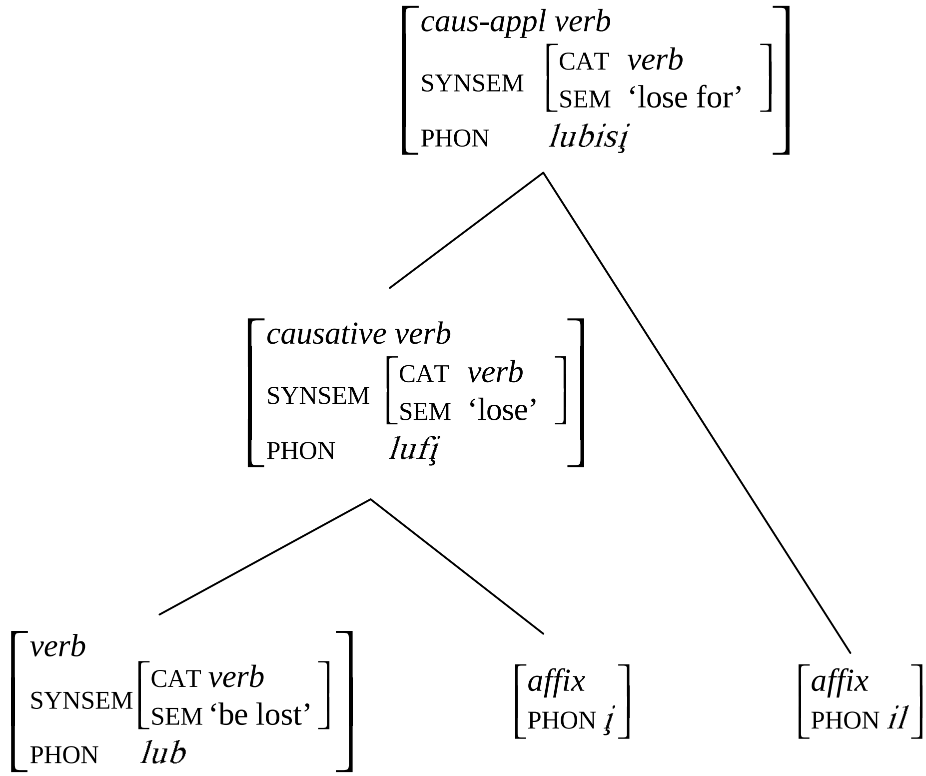
[*applicative verb*
SYNSEM|CAT *verb*
PHON φ_2([1], *il*)]
|
[*verb*
SYNSEM|CAT *verb*
PHON [1]]

The part of the lexical type hierarchy that pertains to applicative verbs is shown in (343):

(343) applicative verbs
applicatives of noncausative verbs — lubil
applicatives of causative verbs — lufisį

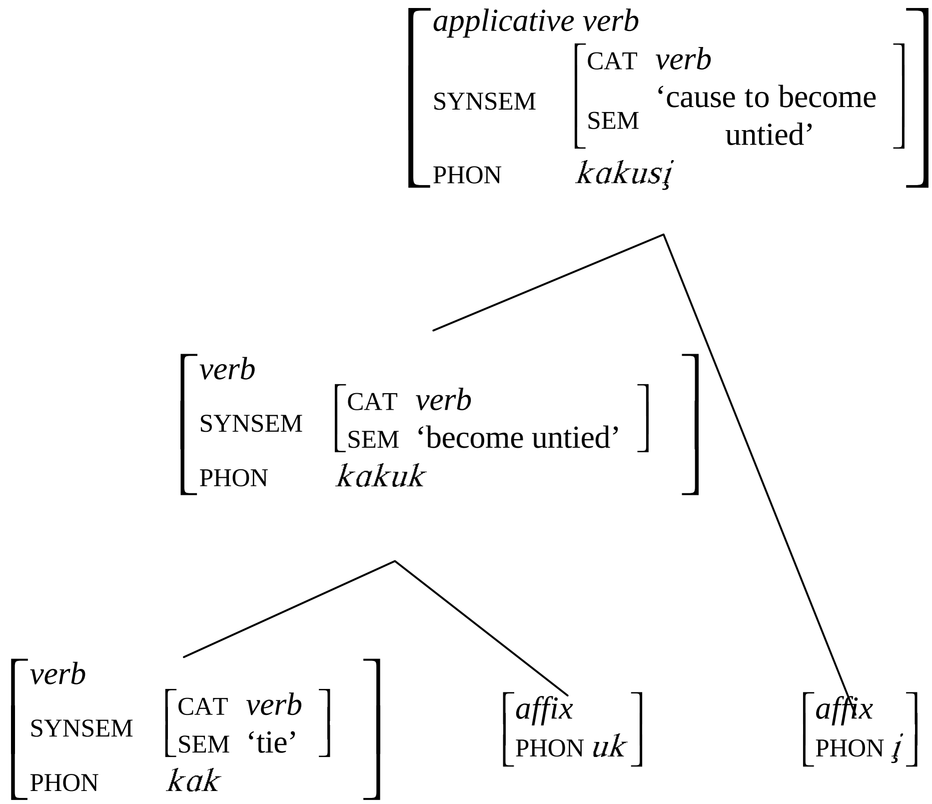
In (344), I show an example constituent structure illustrating the infixation of the applicative *-il* into a causative stem:

(344)



For comparison, I show a form containing the simple suffixing allomorph of the applicative in (345). In this example, the linear order of the morphs reflects their scope relations and their hierarchical positions in the constituent structure. As expected, mutation only applies once, to the [k] of the intransitive reversive:

(345)



In this section, we have seen that Cibemba double mutation, a phenomenon previously analyzed by Hyman by using morphemic circumscription, can be handled in Sign-Based Morphology without violating Bracket Erasure. The reanalysis uses only independently motivated tools, namely reference to lexical types and cophonological allomorphy. I furthermore claim that this analysis is superior to one using morphemic circumscription in that it relates the placement of the "interfixing" allomorph of the causative to crosslinguistic properties of infixes, namely, to the fact that infixes are placed so as to optimize syllable structure (McCarthy and Prince 1993, McCarthy and Prince 1994a, McCarthy and Prince 1994b, McCarthy and Prince 1995 use this same reasoning to argue that their new, alignment-based approach to infixation is superior to the old prosodic circumscription approach of McCarthy and Prince 1986, McCarthy and Prince 1990).

5.7 Conclusions

I have argued in this chapter that a stricter approach to Bracket Erasure effects is possible in Sign-Based Morphology than previously thought. In particular, I have shown that reference to lexical types handles phenomena previously thought to be counterexamples to Bracket Erasure. I have argued that this approach is superior to approaches such as Hammond's (1991) morphemic circumscription. Approaches such as Hammond's make all internal morphological boundary information available to the phonology. However, I have shown that apparent counterexamples to Bracket Erasure all require reference to the fact that a certain morpheme is present in a stem, but never to the location of the morpheme within that stem. This new generalization escaped detection in old theories in which the only way the grammar could access morphological structure was through labeled brackets, which also marked morph boundaries within phonological strings. Sign-Based Morphology, by contrast, marks no morphological breakdown information within phonological strings, this task being taken over completely by the constituent structure skeleton. This architecture allowed an important generalization, previously overlooked, to emerge: the identity but not the location of the outermost morpheme (in terms of constituent structure) in a stem is accessible to the grammar.