Chapter 3. Connections to other theories

In this chapter, I present a more formal and complete introduction to the structure of Sign-Based Morphology and discuss the similarities and differences between Sign-Based Morphology and other approaches to morphology. Sign-Based Morphology owes major insights to a number of past and present approaches to morphology, including ones that are often thought to be mutually incompatible. In this chapter, I show how Sign-Based Morphology utilizes the major insights of a number of different theories, while avoiding their problems.

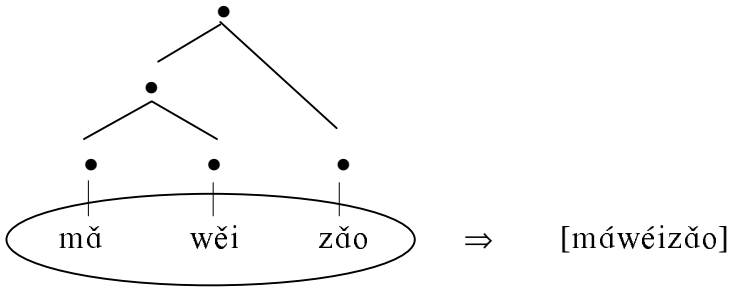
3.1 Why Sign-Based Morphology is different

In this section I introduce the basic structure of Sign-Based Morphology. Although Sign-Based Morphology owes much to a number of different approaches to morphology and phonology, including Lexical Phonology (Kiparsky 1982, Mohanan 1982), Prosodic Lexical Phonology (Inkelas 1988), A-Morphous Morphology (Anderson 1992) and related approaches (e.g., Janda 1983, Zwicky 1994, Stump 1995), and various approaches to morphology within the unification-based linguistic tradition (e.g., Ackerman and LeSourd 1993, Riehemann 1993, 1994, Koenig 1994), I will use as my starting point in this section Lieber 's (1980) dissertation as a well-worked out example of a constituent-structure-based understanding of morphology. It should be noted that the development here does not depend crucially on the details of Lieber's theory and is consistent with any constituent structure approach, including, for example, that of Selkirk 1982.

I begin with a brief discussion of the difference between "sign-based" and "terminal-based" approaches to linguistics (these terms were first introduced in Orgun 1995a). This is a critical contrast to draw, as past criticisms of interleaving (that is, cyclicity or level ordering) as "extraneous" crucially, if implicitly, assume a terminal-based approach to grammar, and are not valid if a sign-based conception is adopted instead. After introducing this important distinction, I demonstrate that there are no truly terminal-based approaches to linguistics. Finally, I show that interleaving effects can be viewed as a direct consequence of using sign-based constituent structures.

In the terminal-based approach, which underlies work in the Structuralist item and arrangement tradition, terminal nodes are the only information-bearing elements in a constituent structure. The sole role of nonterminal nodes is to organize the terminal nodes into groups. The meaning of a linguistic form is assembled from the semantic information in the terminal nodes, while the phonology is determined by some phonological system operating on the strings supplied by the terminal nodes, which are the underlying representations of the morphemes that occupy those nodes. The status of phonology in this kind of model is illustrated in (71) for the Mandarin form *máwéizǎo* 'kelp'.

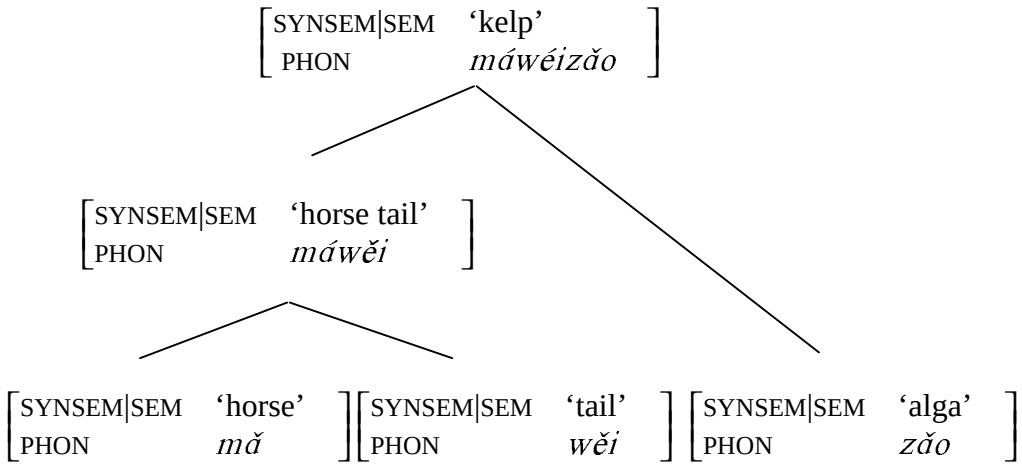
(71) "Terminal-based" approach



Sign-based theories of linguistics differ from terminal-based ones in assuming that every node in a constituent structure, whether terminal or nonterminal, is an information-bearing element. That is, *all* nodes carry syntactic, semantic, and phonological information. The following discussion of sign-based linguistics highlights what is important for the purposes of this study (for a more detailed general introduction, see Shieber 1986 and Pollard and Sag 1987, Pollard and Sag 1994).

A "sign" is defined as a Saussurean pairing between some phonological shape and some semantic information. In sign-based theories, a constituent structure is a statement of how the grammar justifies (licenses) the form-meaning pairing represented by the top node. Example (72) shows a sign-based representation of the same Mandarin form *máwéizǎo* 'it is the friend' whose terminal-based representation was given in (71). The syntactic and semantic features are highly abbreviated for the sake of conciseness.

(72) "Sign-based" approach



Constituent structures have a dual interpretation. They can be seen as representing:

i) the internal part-whole structure of a sign (the syntagmatic interpretation): a constituent structure is a statement of how the grammar licenses the sign comprising the string of linguistic units (terminal nodes) in question. In this interpretation, a sign is understood not as just a simple Saussurean form-meaning pair, but rather as a more

complex representation that has an internal constituent structure which itself contains (smaller) signs.

ii) a statement of what in the lexicon and grammar makes it possible for the sign represented by the top node to exist and how it is related to other signs of the language (the paradigmatic interpretation). In this interpretation, a sign is seen strictly as a Saussurean form-meaning pair. Each node in a constituent structure is thus a sign.

The sign *máwéizǎo* 'kelp' is licensed in Mandarin for the following reasons:

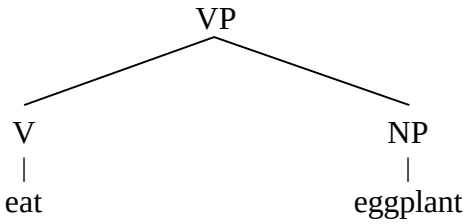
i) the signs *máwěi* 'horse tail' and *zǎo* 'algae' exist

ii) there is a statement in the grammar, that is, a construction, stating that the existence of two nominal signs permits the existence of a third nominal sign (*máwéizǎo*) which combines the phonological and semantic information from these two signs in a particular fashion.

The sign *máwěi* 'horse tail' itself is licensed in a similar manner; the signs *mǎ* 'horse' and *wěi* 'tail' exist in the lexicon, and *máwěi* is the result of combining them in the appropriate way.

Most work in linguistics appears to assume a terminal-based approach; theories which are explicitly sign-based are a distinct minority. However, this contrast is in fact illusory. I am aware of no linguistic theory since Structuralism which attributes no information to nonterminal nodes. All current constituent-based approaches to linguistics use some kind of feature percolation, thereby locating at least some information on the nonterminal nodes. The fact that nonterminal nodes bear category features is enough to illustrate this point. For example, in the constituent structure in (73), the category label of the mother node is the same as the category label of the head daughter, an instance of head feature percolation.

(73)



The need for assigning featural information to nonterminal nodes in a constituent structure was recognized even within the Structuralist tradition by Hockett 1954, who observed that a pure item-and-arrangement view (a pure terminal-based approach in the terminology I use here) is therefore untenable.

The following quote from Pinker 1994 makes even clearer the necessity of feature percolation:

(74) "Take the English noun phrase. A noun phrase (NP) is named after one special word, a noun, that must be inside it. The noun phrase owes most of its properties to that one noun. For example, the NP *the cat in the hat* refers to a kind of cat, not a kind of hat; the meaning of the word *cat* is the core of the meaning of the whole phrase. Similarly, the phrase *fox in socks* refers to a fox, not socks, and the entire phrase is singular in number (that is, we say that the fox in socks *is* or *was here*, not *are* or *were* here), because the word *fox* is singular in number. This special noun is called the "head" of the phrase, and the information filed with that word in memory "percolates up" to the topmost node, where it is interpreted as characterizing the whole phrase as a whole." (Pinker 1994:106-7) [italics added]

Although this quotation describes only head feature percolation, some of the features of a nonterminal node will of course depend on non-head daughters as well (e.g., the contrast in definiteness between *the fox* and *a fox*).

To sum up, Sign-Based Morphology differs from most approaches to morphology in its thorough use of feature percolation. All nodes are assumed to contain syntactic, semantic, and phonological information. As we have already seen in chapter 2, this architecture derives phonology-morphology interleaving effects in a declarative fashion. It has the further advantage of deriving noncyclic phonological effects as well.

3.2 Why Sign-Based Morphology is not different

In this section, I will discuss the insights that Sign-Based Morphology shares with other approaches to morphology.

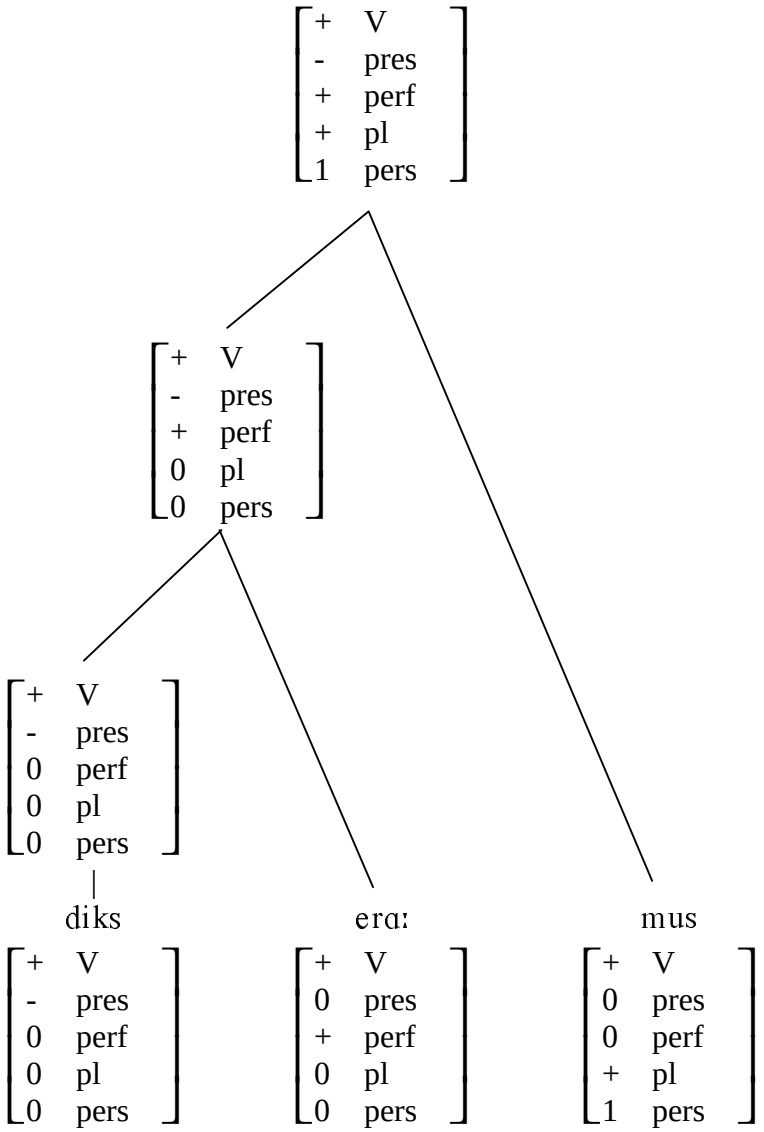
3.2.1 From Lieber 1980 to Sign-Based Morphology: the item-and-arrangement connection

I arue in this section that all constituent structure-based approaches to linguistics can be considered sign-based, because all allow some degree of feature percolation. In all theories, nonterminal nodes bear at least category features. A particularly well worked out theory of feature percolation in morphological structures has been proposed by Lieber 1980. My claim in this section is that Lieber's theory can quite justly be considered sign-based. By starting with Lieber's approach to morphology, and making one minor change that makes the theory internally more consistent, we arrive at Sign-Based Morphology.

Consider the following constituent structure from Lieber 1980:90) for the Latin verb form *dikse:ra:mus* 'say.past-perf-1pl' (where "0" means the value of the feature in question is not specified).[23]

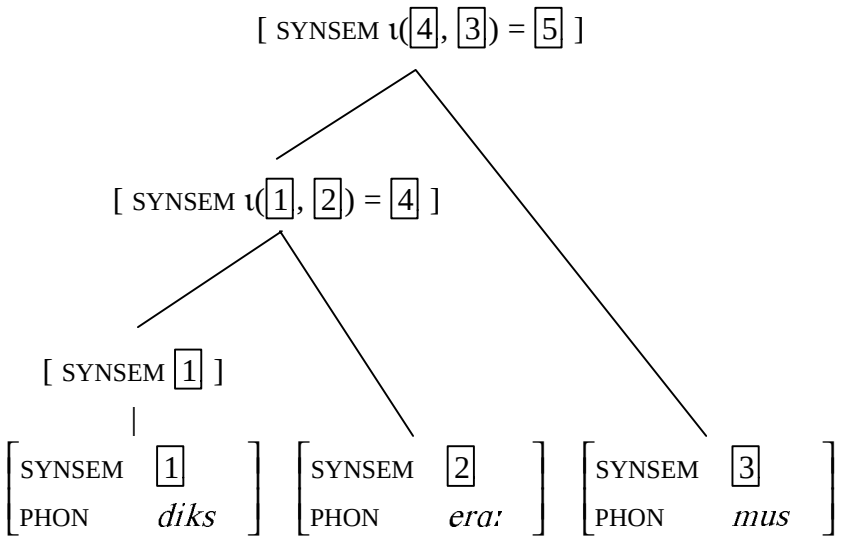
23 The nonbranching dominance of the root diks by a preterminal node is an interesting issue that has to do with the status of "root cycle" effects (that is, bare roots being subject to phonology on their own; see, for example, Kiparsky 1982 and Mohanan 1982, 1986. I abstract away from this issue, pending further investigation within Sign-Based Morphology.

(75)



The morphosyntactic and semantic features of each nonterminal node are determined by a number of "feature percolation conventions" in Lieber's approach. In any approach using constituent structures, the feature composition of a nonterminal node will be related to the features of its immediate constituents through some constraints. By notating this dependency as a function, and using SYNSEM and PHON for the syntactic, semantic, and phonological features of a given node, we arrive at the following representation of the Latin verb form:

(76)

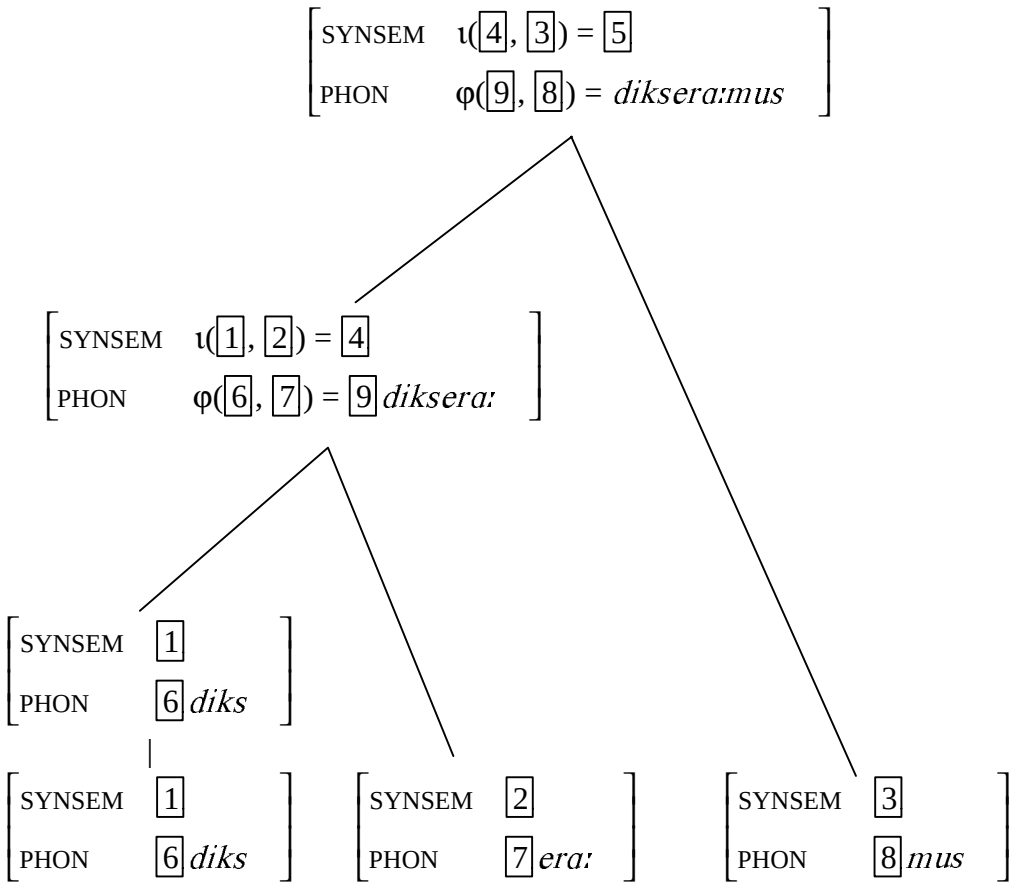


At this point, it is clear that the only terminal-based aspect of Lieber's approach is its treatment of phonology. Nonterminal nodes in Lieber's constituent structures do bear syntactic and semantic information. The decision to single out phonology as the only type of information borne exclusively by terminal nodes is arbitrary.[24]

An internally more consistent approach would treat phonological information on a par with syntactic and semantic information. In such an approach, nonterminal nodes would carry phonological as well as syntactic and semantic information. The phonological information of a nonterminal node would be subject to constraints relating it to the phonology of the immediate constituents. The resulting representation of the Latin verb form is shown in (77).

24 This arbitrary decision costs Lieber's approach dearly: she is forced to assign nonconcatenative morphology to a separate "transformational" module, as terminal-based constituent structures are unable to deal with such phenomena.

(77)

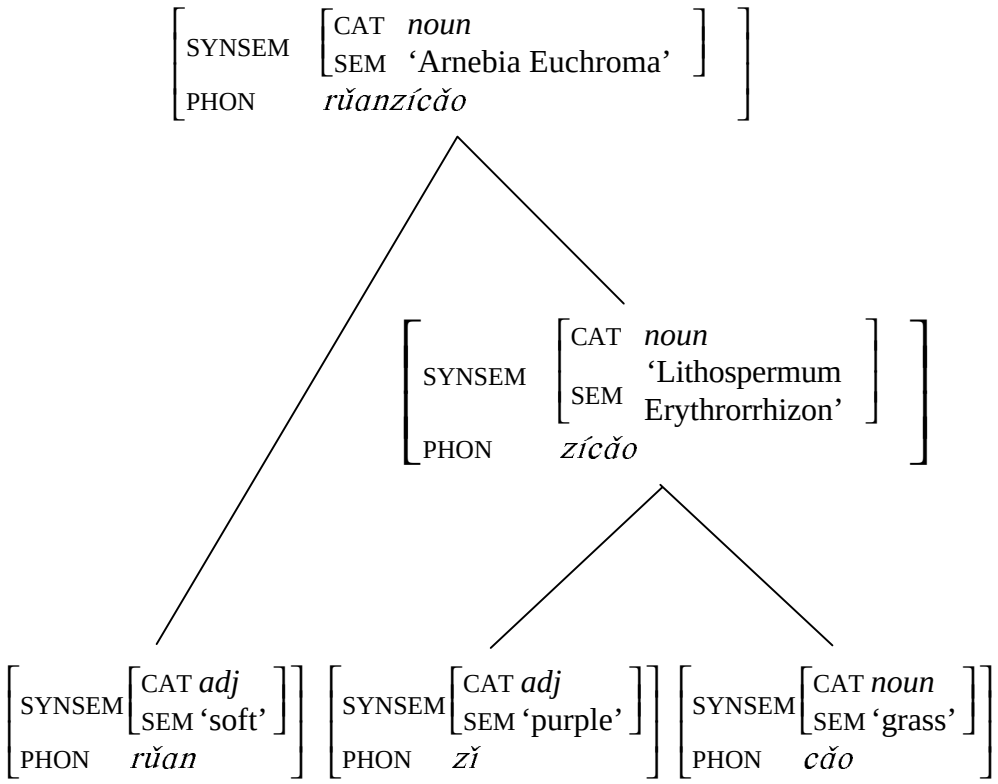


This is of course identical to a sign-based representation.[25] At this point, it should be clear that even approaches stated in terminal-based terms in fact possess all the tools necessary to achieve a nonderivational account of interleaving effects. Criticisms of interleaving as "derivational" or "formally extraneous" (for example, Cole 1990, Goldsmith 1993, Karttunen 1993, Kennedy 1994, Benua 1995, Kenstowicz 1995, Benua 1996) are aimed at the specific model assumed in Lexical Phonology, which was indeed derivational. However, the discussion above makes it clear that a declarative, constituent structure based theory of linguistics possesses all the tools to develop a declarative theory of cyclic phonological effects. Sign-Based Morphology thus does away with the fear that any direct account of cyclic phonological effects must be derivational.

I will end this section with a brief demonstration of how the sign-based architecture derives the apparent cyclic application of Mandarin third tone sandhi in a nonderivational manner. A sign based representation of the form *rǔanzícǎo* 'Arnebia Euchroma' is given in (78):

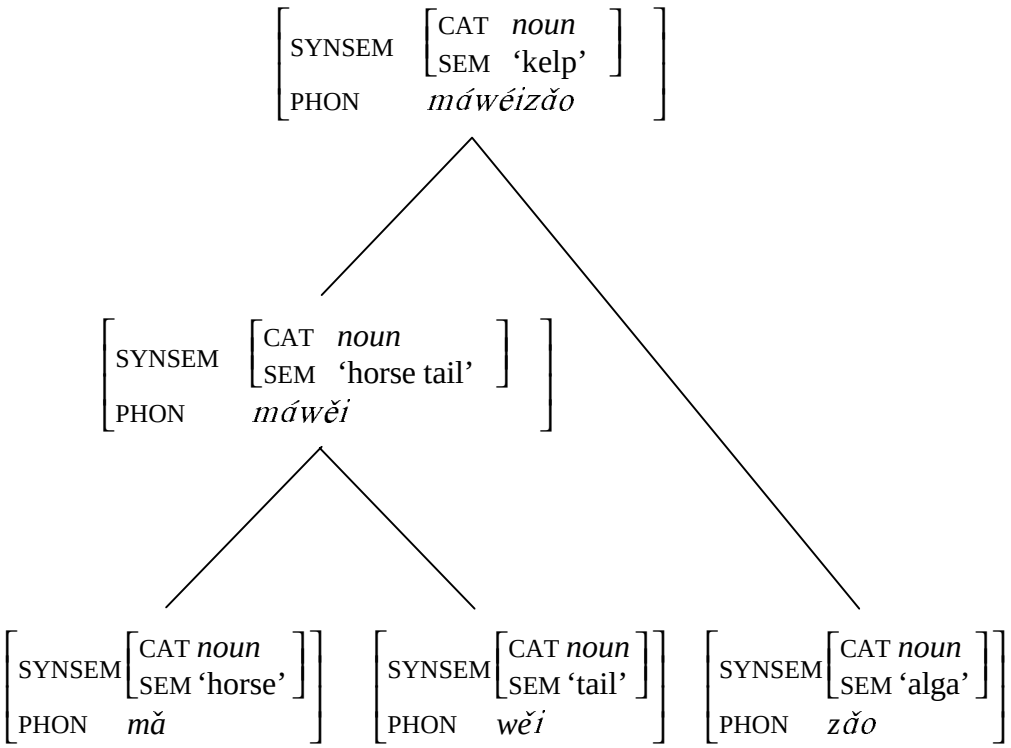
25 Bird (1990) presents the same kind of structure in his introduction to unification-based grammar formalisms. However, he does not recognize the implications of this for interleaving.

(78)



The phonology of the top node in this structure is determined on the basis of the phonologies of its immediate constituents, and *rǔan* and *zícǎo*. Since the environment of tone sandhi is not present in the juncture between these two forms, sandhi does not apply. The structure for the form *máwéizǎo* 'kelp' is shown in (79):

(79)



In this form, the phonology of the top node is similarly determined on the basis of the phonologies of its immediate constituents. This time, the environment of sandhi is met at the juncture between these daughter nodes. Therefore, the top node has a second, rather than a third, tone corresponding to the final third tone of the left daughter.

We have seen how cyclic phonological effects follow as an automatic consequence of local tree wellformedness. The phonology of each node depends on the phonologies of its immediate constituents, deriving interleaving (that is, cyclicity or Level Ordering) effects from static phrase structure configurations. Objections to cyclicity on the grounds that it is necessarily derivational are based on a terminal-based understanding of phrase structures. In such a model, the only way to generate cyclic phonological effects is to apply phonology first to the most deeply embedded constituents, and then successively to larger constituents. This is clearly a derivational model. However, I have demonstrated that:

i) in a sign-based theory, cyclic effects follow in a declarative fashion from static constituent structure configurations, and

ii) all constituent structure-based theories of linguistics possess all the tools needed to utilize the sign-based approach, since nonterminal nodes inherit some information from their daughters in all theories. There is no principled basis for excluding certain types of information from nonterminal nodes. Thus, the notion that cyclic phonology is

necessarily derivational is just as mistaken as the notion that nonterminal nodes are completely devoid of features (even category features).

The fact that a mother node's phonology may differ from its daughters' phonologies is no more derivational than, for example, the fact that a mother node's syntactic category feature may be different from the syntactic category of some of its daughters.

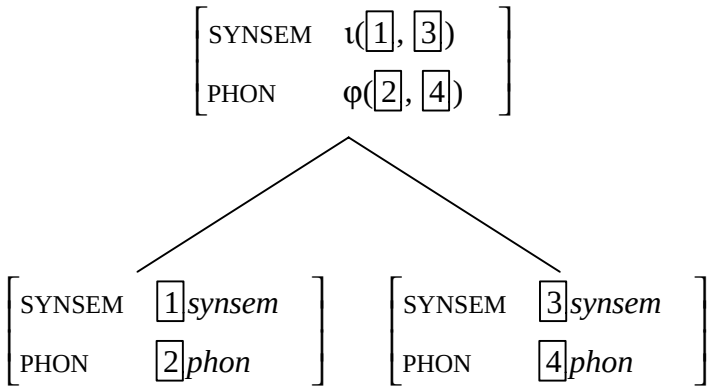
This declarative way of deriving cyclic effects from constituent structures turns out to have a number of theoretical and empirical advantages over alternative approaches. The rest of the work is devoted to exploring these advantages, and developing Sign-Based Morphology in more detail.

3.2.2 The item-and-process connection

The most important aspect in which the realizational view of morphology differs from the more common (at least among phonologists) constituent structure-based view is in its treatment of affixes. In the traditional constituent structure view, affixes are represented as terminal nodes, just like roots, as I have been doing in this study. Realizational morphologists such as Aronoff (1976), Anderson (1990), Zwicky (1995), and Stump (1995) argue against this assumption, favoring instead an approach in which stems in the lexicon are related to other stems by "morpholexical rules", statements of morphological operations. Affixal material is not listed in the lexicon. It is rather introduced by morpholexical rules. Advantages of this model include successful handling of nonconcatenative morphology such as truncation, for which a pure item-and-arrangement representation is impossible.

Because I have presented Sign-Based Morphology by taking Lieber's (1980) constituent structure view of morphology, the reader may think that it is inconsistent with a realizational view of morphology, and is therefore subject to all the criticisms of item-and-arrangement models. This, however, is not true, as I show in this section. Although I have been using constituent structures as convenient notational devices, Sign-Based Morphology is in fact quite close in spirit to realizational views of morphology. I start with a discussion of the representation of affixes in Sign-Based Morphology. First, however, I present a schematic representation of a compound structure. This will serve as a point of reference for some of the basic architectural elements of Sign-Based Morphology in the following discussion of affixes.

(80) Representation of compounds



Much of the following discussion of affixation in Sign-Based Morphology will be concerned with the nature of φ, the phonological constraint system that relates a mother node's phonology to its daughters' phonologies.

Affixes can be treated in three different ways in Sign-Based Morphology. These are summarized in (81):

(81) a) Affixes are terminal constituents (item-and-arrangement).

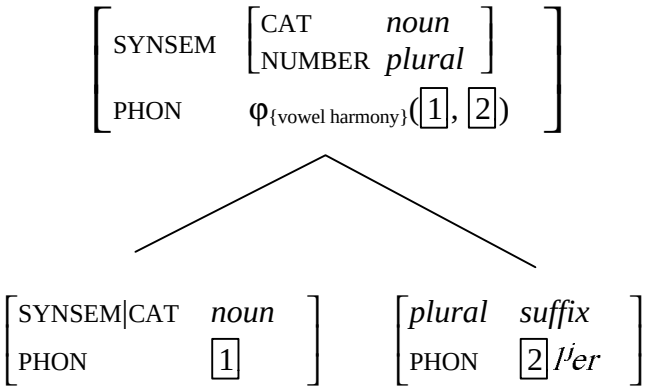
b) Affixal material is introduced by φ (item-and-process).

c) Affixes are fixed arguments to φ specified in affixation constructions.

I will discuss these three options in this section. Although I have used option (81a) so far in this study due to its visual appeal, I will in fact come down in favor of (81c). All options handle concatenative morphology equally well, differing only in their treatment of nonconcatenative morphology.

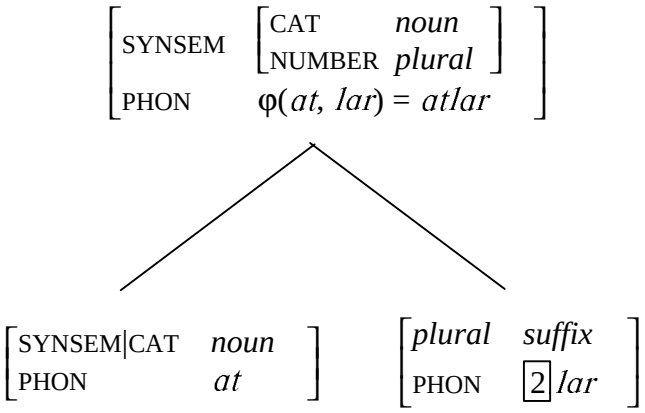
In the first approach (81a), affixes are represented as terminal nodes, in the same way as roots are. Thus, the construction that adds the Turkish plural suffix -*lʲer* to a noun would be represented as in (82):

(82)



In (82) the indices [1] and [2] indicate identity. The subscript annotation on the function φ is a reminder to the reader that indicates some of the phonological alternations enforced by φ, in this case, vowel harmony. In (83), I show a word (*atlar* 'horses') licensed by this affixation construction:

(83)



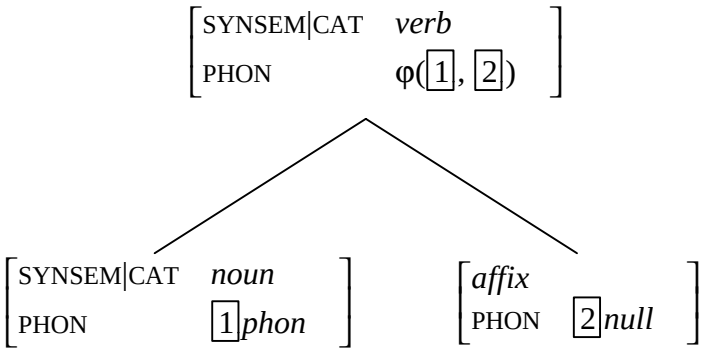
It should be noticed that the terminal node corresponding to the affix is somewhat redundant: all the information contained in this node that is relevant to the surface form is found in the mother node as well. Thus, it should be possible to eliminate the affix node altogether, and encode the relevant information directly in the mother node, a point made by Riehemann 1994 and Koenig 1994. This move would also have various advantages, including the following: there would be no need to choose between "zero affixes" and morphological conversion constructions (i.e., affixless morphological constructions)—the two would be indistinguishable. In the item-and-arrangement approach (where affixes are represented as terminal constituents), it is possible to contrast analyses with phonologically null affixes with analyses with unary dominance (no affix). Consider, for example, zero-derived denominal verbs in English (84):

(84)

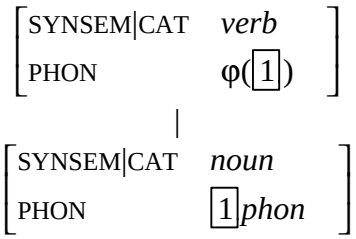
Noun	Verb
table	table
chair	chair
cage	cage
frame	frame

If we represent affixes as terminal nodes, we have two options for the representation of the construction that licenses the forms in (84). We could either represent the construction with a zero affix (85a), or with no affix (85b):

(85) a) zero affix



b) no affix[26]

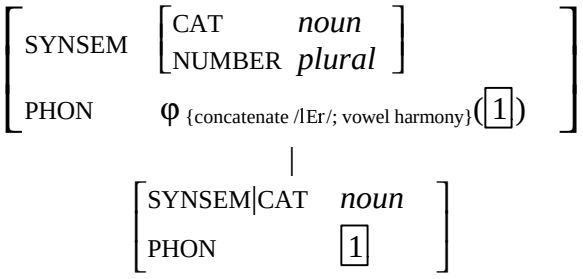


If we do not represent affixes as terminal nodes to begin with then this arbitrary choice between zero morphology as zero affixation versus zero morphology as unary dominance does not arise. Unary (nonbranching) dominance is the only choice. This is a desirable property for a formal approach to morphology to have, as arbitrary choices should be avoided in principle (see Pullum and Zwicky 1991 for other strong arguments against approaches to morphology that use or even allow zero affixes). In the affixes-as-terminal nodes approach, zero affixes could of course be ruled out by stipulation, but to the extent that ruling things out by architecture is more desirable than ruling things out by fiat, the approach in (85) is preferred.

A further advantage of representing affixation in terms of unary dominance constructions is that there is no need to make a formal difference between concatenative and nonconcatenative morphology—the only difference between the two would be in the nature of the phonological mapping φ. In this approach, the Turkish pluralization construction would be as shown in (86):

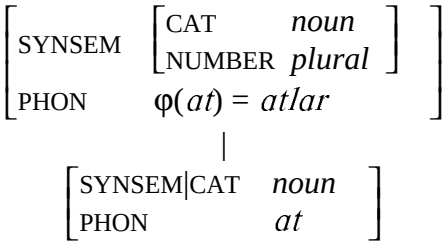
26 The vertical line connecting the nodes in structures such as this one represents nonbranching dominance. That is, the lower node in such structures is the sole immediate constituent of the higher node.

(86)



The structure of the word *atlar* would then be as in (87):

(87)



This approach is equivalent to a "realizational" conception of morphology (e.g., Anderson 1992, Janda 1983, Stump 1995, Zwicky 1994), in which morphemes are "rules" rather than "things". However, this conception has a serious drawback: Phonology in this approach has to be able to insert arbitrary amounts of material (corresponding to affixes). Such phonological rules are unnatural, and should be avoided in principle. This is especially true because deletion or other kinds of prosodic circumscription (McCarthy and Prince 1990) are restricted to a single prosodic unit (e.g., a single segment, syllable, or foot).[27] Such a restriction should follow from the theory of phonology (i.e., of φ). The approach to affixation represented in (86) would be hard put to answer the following question: why is deletion restricted to target a single prosodic unit, while insertion is able to target an arbitrary amount of material?

In past item-and-process inspired approaches to morphology (e.g., Anderson 1992), this problem was sidestepped by decoupling "morphological rules" from "phonological rules". In such approaches, it is assumed that a morphological rule inserts the affix material. Regular phonological rules then apply to the resulting string. This way, phonological theory can be formulated in a principled way, without being corrupted, so to speak, by rules that insert arbitrary amounts of material. A typical derivation in such a framework may look like the following (88):

27 There are cases of prosodic circumscription in which the circumscribed portion of a form is preserved, and the remainder is deleted (an example is given in (93)). This gives the appearance of deletion of an arbitrary amount of material. However, the fact remains that a single prosodic unit is targeted by circumscription.

(88) a) plural suffixation (morphological rule)

$$\begin{bmatrix} \text{SYNSEM|NUMBER} & \textit{plural} \\ \text{PHON} & \boxed{1} \end{bmatrix} \rightarrow [\text{PHON } \boxed{1} \frown /\textit{Er}/]$$

b) example

input:
$$\begin{bmatrix} \text{SYNSEM} & \begin{bmatrix} \text{CAT} & \textit{noun} \\ \text{NUMBER} & \textit{plural} \end{bmatrix} \\ \text{PHON} & \textit{at} \end{bmatrix}$$

output of plural suffixation:
$$\begin{bmatrix} \text{SYNSEM} & \begin{bmatrix} \text{CAT} & \textit{noun} \\ \text{NUMBER} & \textit{plural} \end{bmatrix} \\ \text{PHON} & \textit{at} + /\textit{Er} \end{bmatrix}$$

output of phonology:
$$\begin{bmatrix} \text{SYNSEM} & \begin{bmatrix} \text{CAT} & \textit{noun} \\ \text{NUMBER} & \textit{plural} \end{bmatrix} \\ \text{PHON} & \textit{atlar} \end{bmatrix}$$

This solution is derivational and is therefore not readily available in Sign-Based Morphology, where a single function φ declaratively relates the daughter and mother node phonologies. Whatever insertion of phonological material there is has to be performed by φ. Decoupling phonological epenthesis from "morphological insertion" would require creation of another attribute, which we may call MORPH, which has as its value the result of the "morphological rule". Example (89) illustrates an implementation of this in what may still be considered a typical Andersonian system.

(89) a) Revised morphological rule

$$\begin{bmatrix} \text{SYNSEM|NUMBER} & \textit{plural} \\ \text{MORPH} & \boxed{1} \end{bmatrix} \rightarrow [\text{MORPH } \boxed{1} \frown \textit{lEr}]$$

input:
$$\begin{bmatrix} \text{SYNSEM} & \begin{bmatrix} \text{CAT} & \textit{noun} \\ \text{NUMBER} & \textit{plural} \end{bmatrix} \\ \text{MORPH} & \boxed{1}\textit{at} \\ \text{PHON} & \varphi(\boxed{1}) = \textit{at} \end{bmatrix}$$

output of plural suffixation:

$$\begin{bmatrix} \text{SYNSEM} & \begin{bmatrix} \text{CAT} & \textit{noun} \\ \text{NUMBER} & \textit{plural} \end{bmatrix} \\ \text{MORPH} & \boxed{1}\,\textit{at} + \textit{lEr} \\ \text{PHON} & \varphi(\boxed{1}) = \textit{atlar} \end{bmatrix}$$

As stated, this approach is still derivational: it takes a plural stem lacking the proper morphological expression of the plural feature, and then adds the plural morph to it. A nonderivational account would license the plural form directly in terms of static constraints on constituent structure. This can be done by formulating a plural construction that takes a bare noun stem as a daughter node and requires the presence of the plural suffix material in the mother's MORPH value (90):

(90) a) Pluralization construction

$$\begin{bmatrix} \text{SYNSEM} & \begin{bmatrix} \text{CAT} & \textit{noun} \\ \text{NUMBER} & \textit{plural} \end{bmatrix} \\ \text{MORPH} & \boxed{2}(\boxed{1} \frown \textit{lEr}) \\ \text{PHON} & \varphi(\boxed{2}) \end{bmatrix}$$

$$\Big|$$

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

b) example

$$\begin{bmatrix} \text{SYNSEM} & \begin{bmatrix} \text{CAT} & \textit{noun} \\ \text{NUMBER} & \textit{plural} \end{bmatrix} \\ \text{MORPH} & (\text{at} + \text{lEr}) \\ \text{PHON} & \varphi(\text{at} + \text{lEr}) = \textit{atlar} \end{bmatrix}$$

$$\Big|$$

$$\begin{bmatrix} \text{SYNSEM|CAT} & \textit{noun} \\ \text{PHON} & \textit{at} \end{bmatrix}$$

We now have an approach that has the following properties:

i) affixes are not constituents

ii) affix material is not inserted by φ.

This approach successfully decouples insertion of phonological material by the morphology (such insertion is specified as part of the MORPH value in affixation constructions) from insertion of phonological material by the phonology (such insertion is

handled by the phonological mapping φ). This decoupling puts us in a good position to develop a principled phonological theory that does not need to lose insights because of the necessity to incorporate arbitrary insertion rules. However, the representation in (89) suffers from a degree of unwanted redundancy. The MORPH value is entered as an argument to the phonological function φ. The sole function of the MORPH attribute is to assemble the appropriate argument to φ. It would be possible, and more desirable, to introduce affixal material directly as a fixed argument to φ in affixation construction. We could then eliminate the MORPH attribute, which has very low utility. There is a way to do this in Sign-Based Morphology: we posit a fixed element in the input-phon list of affixation constructions. This fixed element corresponds to the "underlying" form of the affix. This is done for the Turkish pluralization construction in (91):[28]

(91)
$$\begin{bmatrix} \text{SYNSEM} & \begin{bmatrix} \text{CAT} & \textit{noun} \\ \text{NUMBER} & \textit{plural} \end{bmatrix} \\ \text{PHON} & \varphi_{\{\text{vowel harmony}\}}(\boxed{1}, \textit{/Er}) \end{bmatrix}$$
$$\Big|$$
$$\begin{bmatrix} \text{SYNSEM}|\text{CAT} & \textit{noun} \\ \text{PHON} & \boxed{1} \end{bmatrix}$$

This approach to affixation incorporates the insights, and avoids the pitfalls, of both of the approaches we have seen before. Like the realizational approach (but unlike the affixes-as-lexical items approach), it does not suffer from redundancy and a certain degree of arbitrariness regarding zero affixes. Like the affixes-as-lexical items approach (but unlike the realizational approach), it does not interfere with the development of a properly restrictive theory of phonology that does not have the capability to insert arbitrary amounts of phonological material. The structure of the Turkish plural noun *atlar* is now as shown in (92):

(92)
$$\begin{bmatrix} \text{SYNSEM} & \begin{bmatrix} \text{CAT} & \textit{noun} \\ \text{NUMBER} & \textit{plural} \end{bmatrix} \\ \text{PHON} & \varphi(\textit{at}, \textit{/Er}) = \textit{atlar} \end{bmatrix}$$
$$\Big|$$
$$\begin{bmatrix} \text{SYNSEM}|\text{CAT} & \textit{noun} \\ \text{PHON} & \textit{at} \end{bmatrix}$$

28 Although I claim that this approach is superior to the item-and-arrangement approach in which affixes are represented as terminal constituents, it may be argued that the difference between these approaches is mainly notational. In particular, the item-and-arrangement approach suggests (wrongly) that affixes are signs, just like stems (see Riehemann 1994 for more on this point). As long as it is kept in mind that affixes are not meant to be independent lexical items, no harm is done by using a notation in which they are represented as terminal nodes. Since such a notation is visually more appealing, I will in fact continue using it in the rest of this work.

This approach preserves all the advantages of using constituent structures, primary among which is the desire to have a uniform representation for syntax and morphology (while not disregarding their differences, of course).[29] The Structuralists treated syntax and morphology in the same way, applying their item-and-arrangement and item-and-process models to both. In the recent Government and Binding tradition and its descendants, including the Principles and Parameters theory and Minimalism, the desire to treat syntax and morphology in the same way is a major (though by no means unanimously agreed upon) driving force (especially Baker 1988 and Lieber 1992). Criticisms of the methodological stance of trying to make syntax and morphology similar are based mostly on the disadvantages of the item-and-arrangement nature of most existing theories, and, to an important extent, disadvantages of assuming that affixes are heads, a common property of many approaches to morphology. Sign-Based Morphology satisfies the desire for uniformity, but is not subject to the problems of traditional item-and-arrangement models. For example, truncation, one of the most serious problems for item-and-arrangement models, is handled in Sign-Based Morphology in exactly the same way affixation is. The only difference is in the phonological constraint system φ. Consider, for example, the English nickname formation process which truncates personal names to one syllable (analyzed in Optimality Theory by Benua 1995), as in *Rich* from *Richard*. The Sign-Based Morphological representation of this form is shown in (93):

(93)
$$\begin{array}{c}[\text{phon } \varphi(\text{ɹɪtʃəˑd}) = \text{ɹɪtʃ}] \\ | \\ [\text{phon ɹɪtʃəˑd}]\end{array}$$

The assumption that affixes are heads cannot be held in any version of Sign-Based Morphology, since flat structures involving multiple affixes are allowed. The most natural position to hold is that (at least some) morphological constructions are headless. See Koenig, Orgun and Jurafsky 1996 for discussion of this point.

Not all of the advantages of assuming a constituent structure-based approach to morphology are methodological or aesthetic, however. Sign-Based Morphology does share a lot with realizational views of morphology, but it has one marked empirical advantage: it deals with noncyclic phonological effects without difficulty, and relates them

29 I claim that the differences between syntax and morphology are partly due to the fact that syntax deals mostly with free constituents (that is, elements that can participate in a variety of constructions), while morphology mostly deals with bound elements (those represented as constructions). Although this issue is very involved and cannot possibly be resolved in a one-volume work, note that there is a precedent to this kind of reasoning in Riehemann's sign-based approach to morphology. She rejects the word-syntactic approach of Krieger and Nerbonne 1993 in favor of a construction-based approach that is quite similar to Sign-Based Morphology. Krieger and Nerbonne 1993 represent affixes as independent lexical entries that have a valence requirement for the appropriate host. Usual X-bar schemas then combine affixes with their hosts. As Riehemann points out, this approach predicts that syntactic effects such as dislocation and ellipsis of constituents should be possible in morphology as well. This is of course not true. The lack of such effects follows immediately from the fact that affixes are represented as constructions rather than as independent lexical entries: the construction-based representation ensures that affixes must always occur attached to stems.

to independently motivated morphological structures. While realizational approaches derive cyclic phonological effects with equal elegance to Sign-Based Morphology, it is not clear how they would relate the cyclic-noncyclic contrast to independently motivated morphological structures (since such approaches, in general, reject the very existence of morphological structure).

In conclusion, Sign-Based Morphology offers a unique amalgamation of insights and advantages from constituent structure-based and realizational approaches to morphology, showing first that the two approaches are not as different as usually assumed, and, secondly, that it is possible to have the best of both worlds.

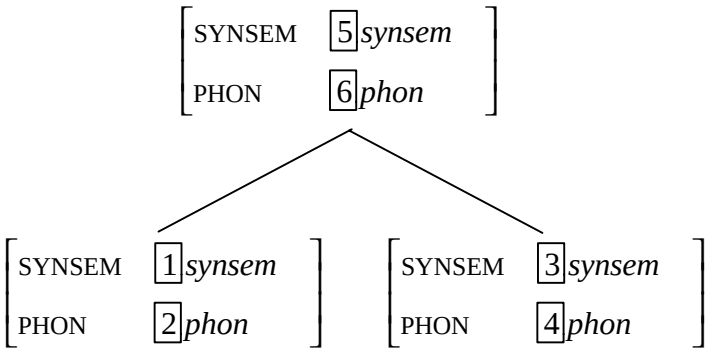
3.3 The sign-based connection

This section explores the connections between Sign-Based Morphology and other sign-based theories of linguistics.

In this section, I also make some of the connections between Sign-Based Morphology and unification-based theories of linguistics such as HPSG (Pollard and Sag 1987, Pollard and Sag 1994) and Construction Grammar (Fillmore and Kay 1994, Fillmore and Kay 1996) somewhat more explicit.

The basis of Sign-Based Morphology is the "local tree", that is, a mother node and its immediate constituents. All grammatical constructions are stated as constraints on local trees that they license.[30] A constituent structure is wellformed if and only if all the local trees in it are wellformed (i.e., licensed by grammatical constructions or lexical items). The structure of a generic local tree is shown in (94):

(94)

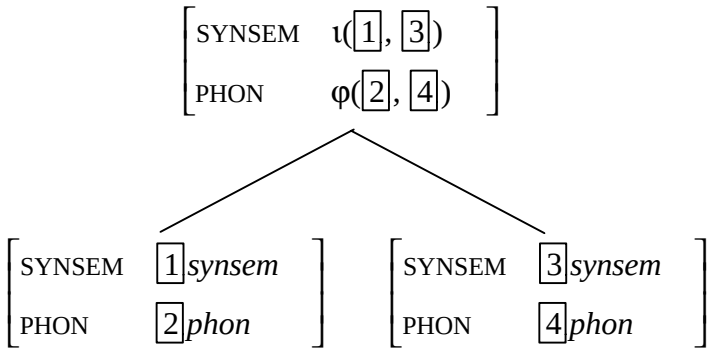


Each node in (94) is a sign, that is, a Saussurean pairing of meaning (the value of the SYNSEM attribute) and form (the value of the PHON attribute). The dependency between the mother and daughter node features is handled by a set of constraints. A number of such constraints have been proposed in the unification-based grammar literature; the

30 It is possible that "extended family" constructions (that is, constructions that mention more levels of constituents than just a mother and its daughters) are necessary, as argued by Fillmore et al. 1988. In Sign-Based Morphology, the restriction of constructions to local trees derives a means to handle Bracket Erasure effects (chapter 5). If extended family constructions are allowed, the insights regarding Bracket Erasure effects can still be preserved by restricting phonology to refer only to the phon attributes of the immediate constituents.

"Head Feature Principle" of HPSG (Pollard and Sag 1987, Pollard and Sag 1994) is one. For visual perspicuity, it is convenient to express this dependency as a function, as in (95):

(95)



This notation should not be taken to imply that the mother node's features are derived from the daughter nodes' features. It is simply a statement that there exist a number of grammatical constraints such that any given triplet of signs will either be licensed (accepted as wellformed) or rejected.[31] The function notation also makes clear the mutual dependency between the mother node and the set of daughter nodes: Assume that the grammatical construction to license this local tree is known. Then, given the daughter nodes, there will be only one possible sign for the mother node that will be licensed (modulo free or stylistic variation). Similarly, given the mother node, there will be a unique set of daughter nodes that will be licensed (modulo ambiguity). The grammar is thus nonderivational. It can be used both for production and processing, but does not favor either over the other, a common property of declarative grammars. The function notation will be used in the rest of this study. It should be kept in mind that a directional application is never meant by this; the correct interpretation is always in terms of constraints holding over lists of signs.

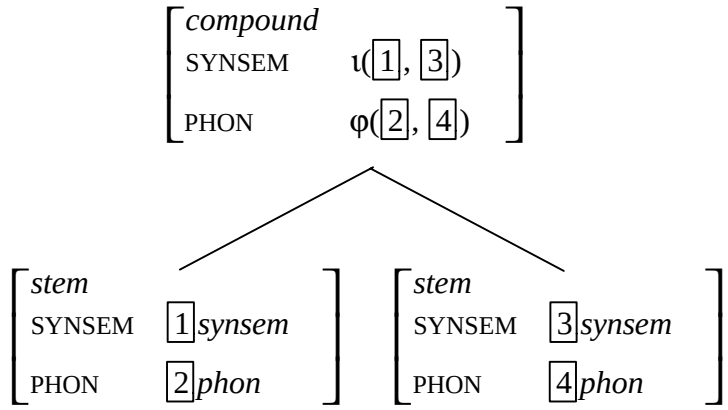
3.4 Sign-Based Morphology how-to

3.4.1 Compounding

Compounding is the simplest type of morphological construction to handle in that there is general agreement among linguists on the right way to deal with it. All theories of morphology deal with compounding as a construction that relates three items. Two of these three items are the stems or words that are members of the compound, and the third is the resulting compound stem or word. In Sign-Based Morphology, this is expressed by a construction whose daughter nodes are the stems that are compounded (96):

31 This view has also been adopted by Kathol (1995), who offers a formal account. Briefly, the notion of licensing a sign σ1 amounts to saying that σ1 is a morphologically simple lexical entry (a bare root) or that there are signs σ2 and σ3 (assuming binary branching constituent structures; for n-ary branching structures, we need to have n signs) such that ℜ(σ1, σ2, σ3) holds for a relation ℜ from a finite set of possible licensing relations (which I am calling "constructions" in this work).

(96)

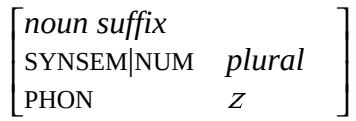


The annotation in italics in the upper left hand corner of signs identifies the lexical type that the sign is an example of. Types will be discussed more fully in section 5.2.3. For now, it suffices to say that every object (all signs and constructions, as well as all attribute values) is typed. The compounding construction in (96) requires its daughters to be of type *stem*, and specifies the mother node as of type *compound* (which is a subtype of *stem*, since, in general, compounds may be members of a bigger compound, as in the Mandarin examples in section 1.1). The examples of cyclic phonological effects in Mandarin tone sandhi in section 1.1 had to do with compounding. The reader may wish to refer back to those examples of the sign-based representation of actual compound words.

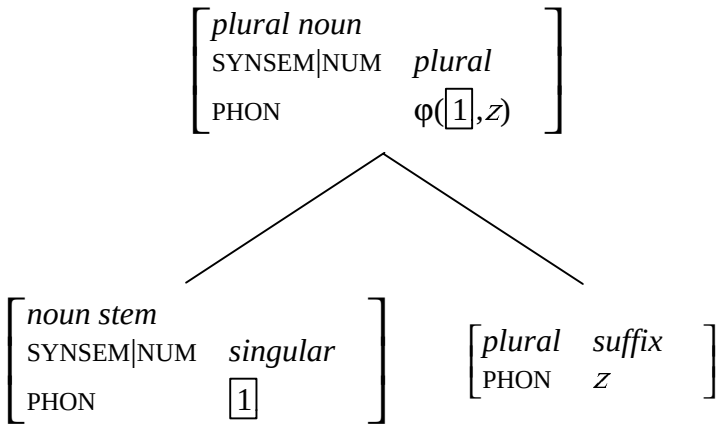
3.4.2 Affixation

The representation of affixes is slightly more challenging than compounding. With affixes, it is necessary to provide not just a description of the affixal material, but also some statement of what class of stems the affix can attach to. This was not necessary in the case of compounding, since the members of a compound are ordinarily free stems, that is, stems that can occur in a variety of contexts, and, usually, can be used as words on their own without further morphology. Affixes, on the other hand, must, by definition, always attach to a stem. If we were to provide affixes with a lexical entry, we would also need a construction that attaches the affix to the appropriate type of base. For example, for the English plural morpheme, we might posit the following lexical entry and construction (97):

(97) a) Lexical entry



b) Construction



At this point, it should be clear that the lexical entry in (97a) serves no purpose at all. The construction in (97b) contains all the information necessary to represent the affix material as well as the attachment requirements of the affix. Accordingly, affixes are represented as constructions as in (97b) in Sign-Based Morphology. The inclusion of a terminal node corresponding to the affix in affixation constructions is somewhat misleading. In particular, it suggests that the affix is still being represented as a sign. This is not intended, however. The affix has no life outside of the construction. It is not listed as an independent lexical item by itself. In section 3.2.2, I have shown how it is possible and desirable to eliminate the terminal node corresponding to the affix in (97b). This move brings Sign-Based Morphology closer to realizational views of morphology. However, I will continue using the representation in (97b) due to its greater visual appeal. The reader interested in the issue of item versus process based views of morphology may wish to refer back to section 3.2.2. It will then be a simple matter of typographic substitution to convert the apparently item based representations in this work to representations in which affixes are not items.

The idea of representing affixes as constructions is in the same spirit as the "subcategorization frames" used in past constituent structure-based theories of morphology such as that of Inkelas 1988. The same idea has already been used in sign-based linguistics by Riehemann 1993, 1994. We will see that a number of empirical predictions follow from this choice, and are supported by data from a variety of languages.

3.4.3 Nonconcatenative morphology

Nonconcatenative morphology is often argued to be a problem for constituent structure-based views of morphology (e.g., by Janda 1983, Anderson 1992). Indeed, the otherwise well worked-out theory of Lieber 1980 has no satisfactory way of dealing with nonconcatenative morphology, but instead relegates it to a separate, "transformational", component of the lexicon, while concatenative morphology is handled in the simple phrase structure component. This difficulty faced by past constituent structure-based approaches is, however, not intrinsic to using constituent structures. Rather, it is a consequence of the ill-advised choice of terminal-based constituent structures. That is, it is Lieber's arbitrary

decision to single out phonology as the only type of information that is outside the scope of percolation that forces her to posit a separate transformational lexical component to handle nonconcatenative morphology. As I show in this section, Sign-Based Morphology does not run into this problem, thanks to its sign-based architecture.

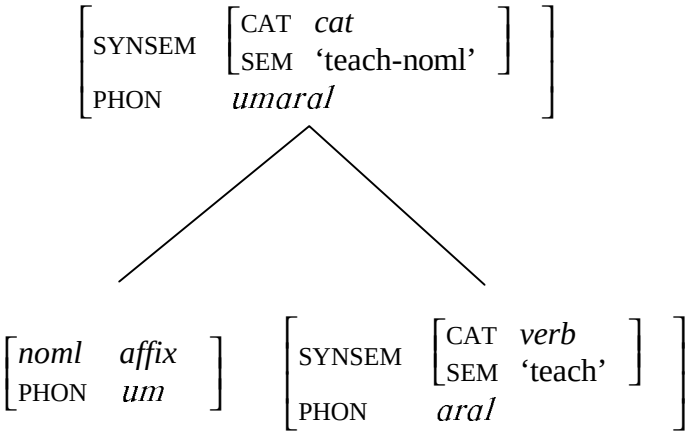
Let us start with infixation, a type of nonconcatenative morphology for which a workable terminal-based representation has been proposed by McCarthy 1979. We will later move on to more challenging types of nonconcatenative morphology. The data in (98) illustrate infixation in Tagalog. The data come from Schachter and Otanes 1972. The analysis follows McCarthy and Prince 1993.

(98)

Verb	Nominal	Gloss
aral	<u>um</u>aral	'teach'
sulat	s<u>um</u>ulat	'write'
gradwet	gr<u>um</u>adwet	'graduate'

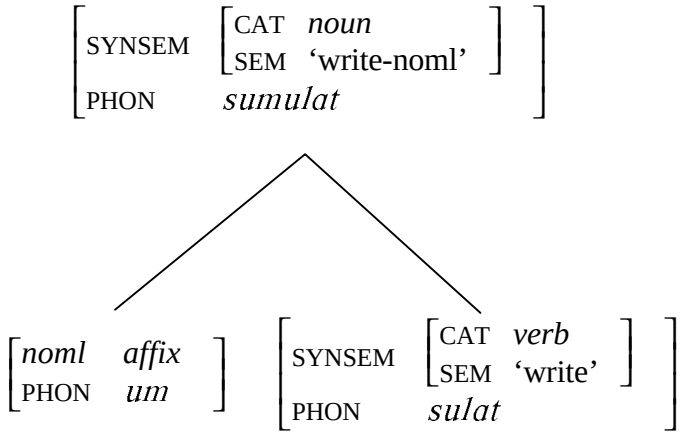
The constituent structure for *<u>um</u>aral* is shown in (99). This is a case of simple prefixation.

(99)



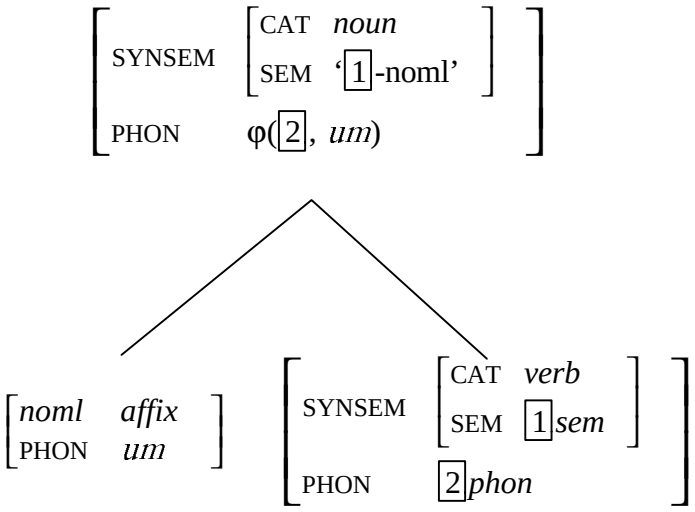
Now, let us consider the constituent structure for the infixed form *sumulat* (100):

(100)



Comparing (99) and (100) reveals no great difference between prefixation and infixation. Both are licensed by the *um* construction in (101):

(101)



The only challenge is to define φ in such a way as to enforce prefixation and infixation of *um* as appropriate. An Optimality Theory account of this phenomenon can be found in McCarthy and Prince 1993 and Orgun and Sprouse 1996a,b. I offer a summary of McCarthy and Prince's analysis here.

The main idea is that *um* is basically a prefix. This is expressed by an alignment constraint requiring *um* to appear at the left edge. This constraint is outranked by syllable-structure constraints (in particular, by a constraint against closed syllables). As a result, *um* is infixed at the expense of an alignment violation when doing so will result in better overall syllable structure. The constraints are summarized in (102):

(102) ALIGN(*um*, L, stem, L) *um* is a prefix
NOCODA syllables must be open

Ranking: NOCODA » ALIGN-*um*

The tableau in) shows how this ranking accounts for the prefixation of *um* on vowel initial stems (e.g., *umaral*), and its infixation into consonant-initial stems (e.g., *sumulat*):

(103)

/um + aral/	NOCODA	ALIGN-*um*
☞ umaral	*	
arumal	*	*!*

/um + sulat/	NoCoda	Align-*um*
umsulat	**!	
☞ sumulat	*	*
sulumat	*	**!*

This approach to nonconcatenative morphology extends readily to nonaffixal morphology of all types. Consider as an example the English nickname formation process for which Benua 1995 has presented an Optimality Theory analysis (but in a different morphological theory). In this construction, the input name is truncated to one syllable (104):

(104) Richard Rich
Thomas Tom
William Will
Patrick Pat

The constituent structure I assume for *Rich* is shown in (93):

(105)
$$\begin{bmatrix} \text{SYNSEM|CAT} & \textit{proper noun} \\ \text{PHON} & \textit{ɹɪtʃ} \end{bmatrix}$$
$$|$$
$$\begin{bmatrix} \text{SYNSEM|CAT} & \textit{proper noun} \\ \text{PHON} & \textit{ɹɪtʃəˠd} \end{bmatrix}$$

The nickname formation construction that licenses this form is depicted in (106):

(106)
$$\begin{bmatrix} \text{SYNSEM|CAT} & \textit{proper noun} \\ \text{PHON} & \varphi(\boxed{1}) \end{bmatrix}$$
$$|$$
$$\begin{bmatrix} \text{SYNSEM|CAT} & \textit{proper noun} \\ \text{PHON} & \boxed{1}\textit{phon} \end{bmatrix}$$

Once again, the only challenge is to devise the appropriate φ. See Benua 1995 for an extensive discussion of the necessary constraint ranking.

We have seen that, unlike terminal-based constituent structure approaches, Sign-Based Morphology runs into no difficulty handling nonconcatenative morphology. The only difference between concatenative and nonconcatenative morphology is in the phonological function φ, a matter for phonological theory. In this work, I have presented, and will continue to present, Optimality Theoretic analyses of most of the phonological alternations considered. However, Sign-Based Morphology is compatible with any declarative theory of morphology.

3.4.4 What is a morpheme?

In this section, I discuss the issue of what a morpheme is from the perspective of Sign-Based Morphology. Essentially, there are two types of morphemes: free roots, which, like morphologically or syntactically complex forms, are signs. Free roots are listed lexically as signs, while complex forms are licensed by constructions that paradigmatically relate them to other (simple or complex) signs. Complex forms may also be listed, of course, in analyzed form if desired. Such listing of complex forms is necessary in the case of noncompositionality, and may be desirable from a psycholinguistic perspective even for some perfectly compositional forms. Bound morphemes (affixes and clitics, and perhaps bound roots as well), on the other hand, are listed as constructions that specify the daughter node (the stem that the affix attaches to) as well as the mother node (the form that the affixation construction licenses).

Sign-Based Morphology appears in one respect to differ from realizational views of morphology: such views often reject the existence of bound morphemes (especially affixes)—the name of Anderson's A-morphous Morphology reflects this position. In Sign-Based Morphology, the claim is that affixes do exist, but only as constructions, not as lexical entries (signs). This is in fact quite similar to the realizational view, where the role of affixes is taken over by morpholexical rules. Sign-Based Morphology's affixation constructions can be seen as a nonderivational version of morpholexical rules.

The issue of what a morpheme is from the perspective of a unification-based theory of grammar has been taken up previously by Rhodes (1992). The approach I present here is similar to his, except that I make a clearer distinction between roots and affixes.

A root is essentially a simple sign, that is, a sign with no subconstituents (107):

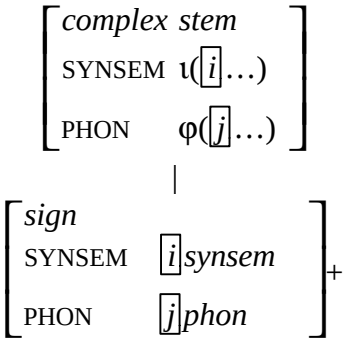
(107) A root (morphologically simple stem)

$$\begin{bmatrix} \textit{root} & \\ \text{SYNSEM} & \textit{synsem} \\ \text{PHON} & \textit{phon} \end{bmatrix}$$

A morphologically complex stem, on the other hand, is a sign that has one or more immediate constituents (108) (where the Kleene + notation indicates one or more signs):[32]

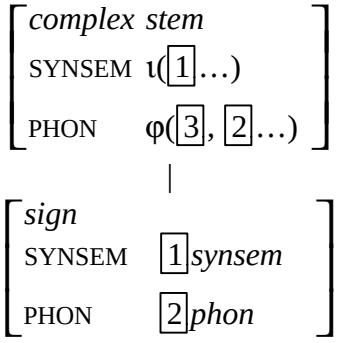
32 The ellipses are meant to indicate that the list of arguments to the semantic and phonological mappings will contain the semantic and phonological information in each daughter.

(108) A morphologically complex stem



An affix is represented as a construction. This is equivalent to representing affixes as partially specified complex stems in which one daughter is unspecified. A fixed argument to the phonological function φ represents the phonological material contributed by the affix (109) (the element indicated as 3 represents the phonological material contributed by the affix):

(109) An affix



Affixation can then be seen as unification of a sign (root or complex form) with the daughter node of a construction like the one in (109).

What is a morpheme? A root morpheme is a simple sign (that is, one with no daughters). An affix is a construction (that is, a partially specified sign—one with an unspecified daughter). In the paradigmatic interpretation of Sign-Based Morphology, this amounts to saying that an affix is a function from a (simple or complex) sign to a (complex) sign.

3.5 Comparison of Sign-Based Morphology with paradigmatic approaches to morphology

In this section, I compare Sign-Based Morphology to some competing approaches to the phonology-morphology interface that use some sort of paradigm uniformity constraint as

their basic tool of handling cyclic phonological effects. I discuss the basics of three types of approaches to morphology that use paradigm uniformity. I call these:

i) strictly paradigmatic approaches,

ii) loosely paradigmatic approaches,

iii) syntagmatic approaches enriched with transderivational identity constraints.

3.5.1 Strictly paradigmatic approaches

Strictly paradigmatic approaches are those that relate all words within a paradigm to each other in one rule or constraint, rather than relating them to each other in pairs, such that a separate rule or constraint system is used to relate each pair. Furthermore, these approaches take an all-encompassing definition of paradigm that allows words that share any morphological property to define a paradigm. For example, in a strictly paradigmatic approach, not only do the words *read*, *reads*, *reading*, *reader*, *unread*, etc. form a paradigm, but so do the words *books*, *cats*, *dogs*, *oranges*, *misgivings*, and so on. Bochner 1993 is an uncompromising example of a strictly paradigmatic approach to morphology. As an illustration of Bochner's approach to morphology, I present the rule he proposes to handle certain regularities in English *-ion* suffixation. The rule applies to paradigms containing forms that bear the suffix *-ion*:

(110)
$$\left\{ \begin{bmatrix} /\text{adXion}/ \\ N \\ A \end{bmatrix}, \begin{bmatrix} /\text{conXion}/ \\ N \\ B \end{bmatrix}, \begin{bmatrix} /\text{deXion}/ \\ N \\ C \end{bmatrix}, \begin{bmatrix} /\text{disXion}/ \\ N \\ D \end{bmatrix}, \begin{bmatrix} /\text{exXion}/ \\ N \\ E \end{bmatrix}, \begin{bmatrix} /\text{inXion}/ \\ N \\ F \end{bmatrix}, \begin{bmatrix} /\text{interXion}/ \\ N \\ G \end{bmatrix}, \begin{bmatrix} /\text{introXion}/ \\ N \\ H \end{bmatrix}, \begin{bmatrix} /\text{obXion}/ \\ N \\ I \end{bmatrix}, \begin{bmatrix} /\text{perXion}/ \\ N \\ J \end{bmatrix}, \begin{bmatrix} /\text{preXion}/ \\ N \\ K \end{bmatrix}, \begin{bmatrix} /\text{proXion}/ \\ N \\ L \end{bmatrix}, \begin{bmatrix} /\text{reXion}/ \\ N \\ M \end{bmatrix}, \begin{bmatrix} /\text{subXion}/ \\ N \\ N \end{bmatrix}, \begin{bmatrix} /\text{transXion}/ \\ N \\ O \end{bmatrix} \right\}$$

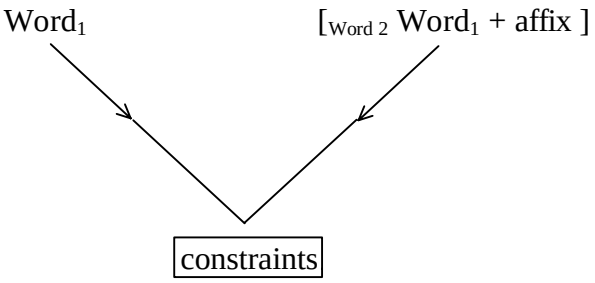
By substituting a fixed string for the variable X, we obtain a set of words. This rule captures the crucial property of *-ion* suffixation that we have already noted, namely, the uniformity of allomorphy across forms containing the same root: since the variable X need not be specified as a single morpheme, the effects of allomorphy will be copied throughout the paradigm by copying the string corresponding to X. For example, in the paradigm for *exclamation*, *proclamation*, *reclamation*, the variable X is specified to be the string *clamat* (note that most of the analyses in Bochner's work are stated in terms of orthography). The capital letter symbols underneath the phonological form represent the

syntactic and semantic features of the words, here left blank because Latinate bound roots ordinarily do not make a reliable semantic contribution to the words they appear in.

3.5.2 Loosely paradigmatic approaches

Loosely paradigmatic approaches relate words in pairs. Their paradigmatic aspect comes from the assumption that all related pairs of items must be independent words, and the rejection that underlying representations exist at all (in some approaches, such as Benua 1995, McCarthy 1996a, underlying representations are still used, but only for morphologically simple forms. Morphologically complex forms are related to morphologically simple forms by constraints that make no reference to underlying representations). Apart from this aspect, these approaches are more syntagmatic in spirit in that they always relate pairs of words to each other rather than deal with full paradigms. Furthermore, all these approaches stipulate that the morphologically simpler form may have an influence on the phonological shape of the more complex word, but not vice-versa. This suggests that the loosely paradigmatic approach is in fact a syntagmatic approach in which the morphologically more complex word is *derived* from the simpler word. In this sense, a loosely paradigmatic approach fits the Structuralist item-and-process mold better than it fits the word-and-paradigm mold. In a true paradigmatic approach, the relation between words in a paradigm would be symmetric, each word being just as likely to influence the other phonologically. Burzio 1994 is a good example of a loosely paradigmatic approach. The following figure represents Burzio's approach to cyclic effects:

(111)



The intended interpretation of this diagram is that certain constraints relate the two words to each other. The picture makes the syntagmatic nature of the approach clear: word 2 is represented as a combination of word 1 and an affix.

Though the loosely paradigmatic approach differs in representation from Sign-Based Morphology, it is quite similar to Sign-Based Morphology in spirit: Both approaches relate forms in pairs. In both approaches, the relation between forms is stated in terms of constraints. There are two aspects in which the approaches differ: first, in Sign-Based Morphology, the relation is inherently asymmetrical. The constraints holding between a mother node and daughter node cannot have any effect on independent occurrences of the daughter node alone or in other constructions. In the loosely paradigmatic approach, constraints are taken to relate the lexical entries of two independent words. The constraints are inherently symmetrical in that they relate two independent words, rather than deriving one word from another, morphologically simpler,

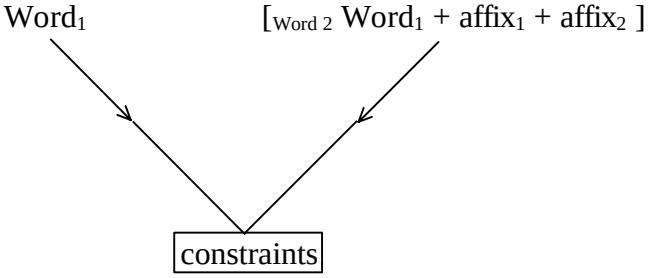
word. Hence the morphologically simpler word might be expected to undergo some kind of phonological change as a result of these constraints just as often as the morphologically more complex one will. Such effects are common in diachronic change involving back-formation or reanalysis, whose source is indubitably paradigmatic. For example Becker 1993 notes that some speakers of English have created a new verb, *cohese*, by back-formation from *cohesion*. The motivation for this reanalysis is that the two morphologically related words *cohere* and *cohesion* stand in a correspondence relation. *Cohere* is just as likely to accommodate phonologically to satisfy correspondence constraints better as *cohesion* is. Indeed, in the dialect that innovated *cohese*, greater featural faithfulness is achieved by altering the simpler word. The well-known case in Latin of *honos* > *honor* (discussed by Bochner 1993 as motivating paradigmatic morphology, though I argue that in fact it provides a strong argument against paradigmatic morphology) is another god example. As (112) shows, greater paradigm uniformity is achieved in Latin by altering the morphologically simpler form phonologically:

(112) Before paradigm leveling: honos honoris
After paradigm leveling: honor honoris

This kind of outside-in effect (that is, a morphologically simpler word phonologically influenced by a morphologically more complex word) is restricted to diachronic change. Synchronic cyclic phonological effects are strictly inside-out, as predicted by Sign-Based Morphology and other theories of the phonology-morphology interface that use a relatively direct implementation of phonology-morphology interleaving.

The second difference is that Sign-Based Morphology allows noncyclic effects, which would translate, in loosely paradigmatic terms, to a structure like the one in (113), where [$Word_1$ + $affix_1$] also exists as an independent word, but is somehow ignored in the constraints imposed on [$Word_1$ + $affix_1$ + $affix_2$]:

(113)



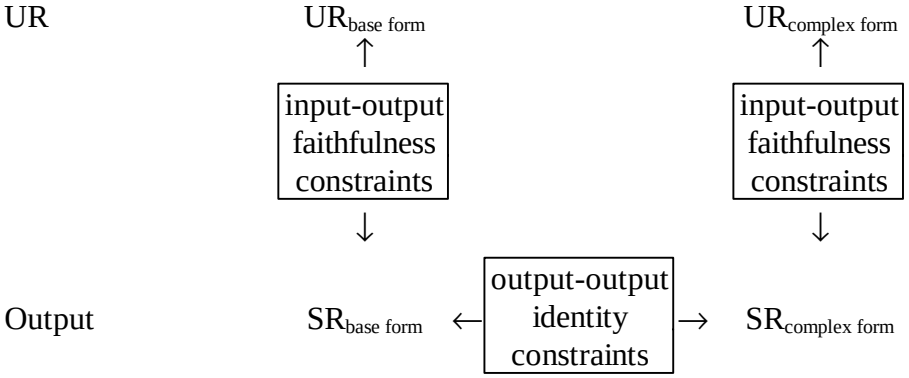
The relation between Sign-Based Morphology and the loosely paradigmatic approach is discussed more fully in section 3.5.6.

3.5.3 Syntagmatic approaches enriched with transderivational identity

The last group of approaches to morphology are not paradigmatic at all, but are included in this section because they owe a certain degree of debt to paradigmatic approaches. In these approaches, represented by Kenstowicz 1995 and Benua 1996, all surface forms are derived from their own underlying representations. But, in addition to the usual input-

output faithfulness constraints, there are also transderivational identity constraints that hold between pairs of morphologically related words. The general constraint scheme of this type of approach is shown in (114):

(114) UR



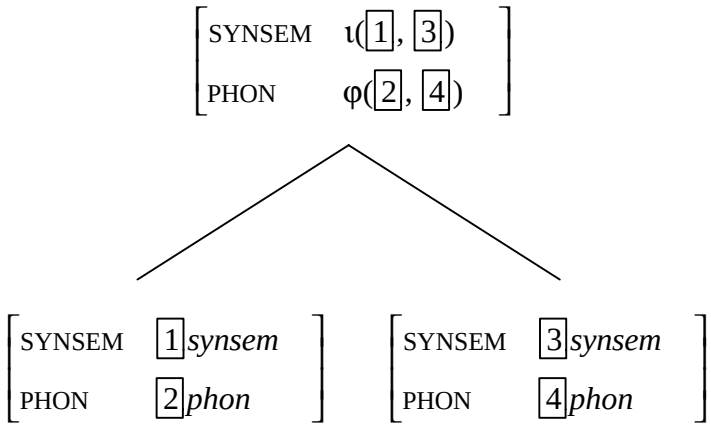
This approach is clearly less restrictive than the loosely paradigmatic approach. In addition to allowing the equivalent of a cyclic derivation, it also allows the equivalent of global reference to underlying representations. I will argue that both of these properties of the syntagmatic approach are grounds for rejecting it.

3.5.4 More on the paradigmatic interpretation of Sign-Based Morphology

Although I have presented Sign-Based Morphology as an essentially syntagmatic theory, it in fact has a quite compelling paradigmatic interpretation. In this section, I make this interpretation more explicit, in line with the general goal of this chapter of showing how Sign-Based Morphology combines insights from seemingly incompatible views of morphology. The paradigmatic interpretation of sign-based linguistics discussed in this section is similar to that proposed by Kathol (1995).

The basis of sign-based approaches to linguistics is the local tree, that is a mother node plus its immediate constituents. The distinguishing property of sign-based theories is that the mother node, just like the daughters, is a full-fledged information structure including (at least) semantic and phonological information. This basic structure is depicted in (115):

(115)



In the usual, syntagmatic, interpretation of sign-based theories, this structure is interpreted as the internal part-whole structure of a sign. The sign represented by a constituent structure includes the mother node and its daughters, which are themselves signs. Thus, the sign represented by the constituent structure contains smaller signs as part of its structure. In terms of licensing, we can describe the situation as follows:

(116) Sign 1:

$$\begin{bmatrix} \text{SYNSEM} & \boxed{1}\textit{synsem} \\ \text{PHON} & \boxed{2}\textit{phon} \end{bmatrix}$$

Sign 2:

$$\begin{bmatrix} \text{SYNSEM} & \boxed{3}\textit{synsem} \\ \text{PHON} & \boxed{4}\textit{phon} \end{bmatrix}$$

Sign 3:

$$\begin{bmatrix} \text{SYNSEM} & \iota(\boxed{1}, \boxed{3}) \\ \text{PHON} & \varphi(\boxed{2}, \boxed{4}) \end{bmatrix}$$

$$\begin{bmatrix} \text{SYNSEM} & \boxed{1}\textit{synsem} \\ \text{PHON} & \boxed{2}\textit{phon} \end{bmatrix} \qquad \begin{bmatrix} \text{SYNSEM} & \boxed{3}\textit{synsem} \\ \text{PHON} & \boxed{4}\textit{phon} \end{bmatrix}$$

Licensing statement: sign 3 is wellformed iff sign 1 and sign 2 are wellformed.

This interpretation of sign-based linguistics uses a concept of "sign" that is somewhat more complicated than the usual Saussurean sense. Root morphemes (that is, morphologically simple forms) are simple Saussurean signs—they consist of semantic and phonological information. Morphologically (or syntactically) complex forms also contain semantic and phonological information. But, in addition, they also contain information about their daughters. That is, these signs contain other signs within them.

The paradigmatic interpretation of sign-based linguistics is based strictly on the Saussurean sense of the term "sign". In this interpretation, each node in a constituent structure is a sign. Constituent structures are taken to be licensing statements for the sign represented by the top node. For example, the licensing statement for the structure in (115) is as follows:

(117) Sign 1:

$$\begin{bmatrix} \text{SYNSEM} & \boxed{1}\textit{synsem} \\ \text{PHON} & \boxed{2}\textit{phon} \end{bmatrix}$$

Sign 2:

$$\begin{bmatrix} \text{SYNSEM} & \boxed{3}\textit{synsem} \\ \text{PHON} & \boxed{4}\textit{phon} \end{bmatrix}$$

Sign 3:

$$\begin{bmatrix} \text{SYNSEM} & \iota(\boxed{1}, \boxed{3}) \\ \text{PHON} & \varphi(\boxed{2}, \boxed{4}) \end{bmatrix}$$

Licensing statement: sign 3 is wellformed iff sign 1 and sign 2 are wellformed.

More concisely, we can use a function notation:

(118) $\text{sign}_3 = f(\text{sign}_1, \text{sign}_2)$

This notation suggests intuitively that sign 3 is derived, in some sense, from sign 1 and sign 2 (although such directionality is not a formally inherent property of functions). This interpretation is quite similar to the item-and-process interpretation of Sign-Based Morphology, discussed in section 3.2.2. However, the item-and-process view need not be viewed as inherently derivational. With this in mind, it is in fact quite similar to the word-and-paradigm view of morphology (as noted by Anderson 1992). To make this more intuitive, we may express the constituent structure licensing statement in terms of a relation:

(119) sign 3 is wellformed iff:

i) sign 1 and sign 2 exist

i) there is a relation $\Re$ in the grammar such that $\Re(\text{sign}_1, \text{sign}_2, \text{sign}_3)$

This interpretation of Sign-Based Morphology is quite similar to the loosely paradigmatic approach discussed in section 3.5.2. The main difference is that the Sign-Based Morphology does not make the stipulation that all signs must be independent words. As there are demonstrable cases of morphological subconstituents that are not themselves words (sections 3.5.6.1, 5.6), Sign-Based Morphology has the empirical edge in this respect. Other differences between the approaches are discussed in section 3.5.6.

In view of the fact that Sign-Based Morphology is quite similar in spirit to realizational approaches to morphology, it is hardly surprising that it also has a plausible paradigmatic interpretation, since paradigmatic morphology and realizational morphology

are intimately connected to each other. It is perhaps more surprising that Sign-Based Morphology is also able to incorporate insights from constituent structure-based views.

3.5.5 Comparison of Sign-Based Morphology with strictly paradigmatic approaches

Although Sign-Based Morphology has a reasonable paradigmatic interpretation, it is quite different in spirit from strictly paradigmatic approaches to morphology such as that of Bochner (1993). Strictly paradigmatic approaches to morphology relate all words that share any given morphological property. For example, all words that share a root morpheme form a paradigm. Similarly, all words that contain the same plural suffix (for example), form a paradigm. Sign-Based Morphology, by contrast, relates stems (not necessarily words) to each other only is there is a grammatical construction explicitly licensing such a relation. For example, in Sign-Based Morphology, the English words *book* and *books* are related to each other by grammatical constraints because there is a pluralization construction that explicitly states that a singular noun may be related to its plural version by the addition of the plural suffix (and the accompanying morphophonemic correspondences). The words *books* and *cats* are not related by grammatical constraints, because there is no grammatical construction that licenses such a relation.

The construction orientation of Sign-Based Morphology is crucial for capturing cyclic phonological effects. The main challenge is determining which forms stand in a correspondence relation for the purposes of phonology. In Sign-Based Morphology, this challenge is addressed by using constructions. Forms stand in correspondence if and only is there is a construction that explicitly allows them to be combined. For example, recall from section 2.1 that suffixed forms must be disyllabic for certain speakers of Istanbul Turkish (120):

(120) a) doː ‘musical note C’

b) *doː-m ‘C-1sg.poss’

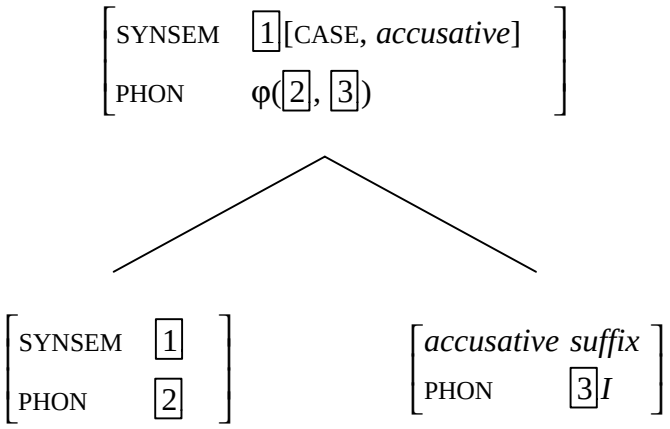
The form **doː-m* remains ungrammatical even when we add a further suffix to it such that the total size is two syllables:

(121) a) *doː-m ‘C-1sg.poss’

b) *doː-m-u ‘C-1sg.poss-acc’

We may conclude therefore that the possessed form in (120b) and the possessed accusative form in (121b) stand in correspondence. This correspondence is licensed by a construction in Sign-Based Morphology (122):

(122) Accusative construction



In the strictly paradigmatic approach, the forms stand in correspondence, because any forms that share morphemes stand in correspondence. It is sufficient that these forms share the same root.

The noun in (120a) can be pluralized in Turkish. The result is grammatical: the plural suffix adds a syllable; the output therefore contains two syllables and satisfies the disyllabic minimal size requirement (124a). When the first person singular possessive suffix is added to this plural form, the resulting noun is still grammatical.

(123) a) doː-lɑr 'C-pl'

b) doː-lɑr-ɯm 'C-pl-1sg.poss'

From this, we may conclude that plural possessed nouns do not interact phonologically with singular possessed nouns. Otherwise we would expect the form in (124b) to be ungrammatical (we know from (121) that forms that stand in correspondence with **doː-m* 'C-1sg.poss' are ungrammatical).

(124) Turkish forms that don't interact:

a) *doː-m 'my C'

b) doː-lɑr-ɯm 'C-pl-1sg.poss'

In Sign-Based Morphology, this result is not surprising. There is no grammatical construction that relates possessed singular nouns to possessed plural nouns. There is therefore no need to expect the nouns in (124) to stand in a grammatical correspondence relation.

The situation is more complicated in the strongly paradigmatic approach: *do:-lar-um* contains all the morphemes in **do:-m*, plus an additional (plural) morpheme. We would therefore expect them to stand in correspondence.

Since the strongly paradigmatic approach allows all forms that share any morphological property to stand in grammatical correspondence, it is unable to deal with cyclic effects. Cyclic phonological effects need to make crucial reference to the morphological structure of a form in terms of dominance relations. By rejecting the existence of such structure, the strongly paradigmatic approach makes it impossible to deal with cyclic effects. Bochner (1993) acknowledges this point in his section 5.5, and claims that cyclic effects in fact do not exist. His main claim is that apparent cyclic effects are always restricted to cases of unproductive morphology, which, he remarks, may be considered a historical relic. Bochner argues that the proper treatment of such cases is by suppletive allomorphy, and an analysis in terms of a single underlying form is not called for:

(125) "… my claim is that all cases [of apparent cyclic phonology] can be treated this way [as suppletion], and that there is no need for cyclic application of phonological rules within the word." (Bochner 1993: 202)

Most of the examples used in this work have to do with freely productive and regular morphology. It therefore appears that strictly paradigmatic approaches do not provide a satisfactory way to deal with the phonology-morphology interface.

One area in which the strictly paradigmatic approach seems to have an empirical advantage is Bracketing Paradoxes (Pesetsky 1985, Spencer 1988, Cohn 1989, Sadock 1991, Becker 1993). Bracketing Paradoxes have not yet been studied in any detail within Sign-Based Morphology. The paradigmatic approach can deal with these by using a paradigm consisting of multiple related words, as discussed by Becker (1993). For example, the following paradigm can be set up to deal with the famous type of Bracketing Paradox exemplified by the English word *ungrammaticality*:

(126) $$\left\{ \begin{bmatrix} \text{/X/} \\ \text{Adj} \\ \text{A} \end{bmatrix}, \begin{bmatrix} \text{/unX/} \\ \text{Adj} \\ \text{not A} \end{bmatrix}, \begin{bmatrix} \text{/Xity/} \\ \text{N} \\ \text{state of being A} \end{bmatrix}, \begin{bmatrix} \text{/unXity/} \\ \text{N} \\ \text{state of being not A} \end{bmatrix} \right\}$$

This paradigmatic statement captures the insight expressed by Kiparsky (1983) that Bracketing Paradoxes of this type are blends of some sort: a word of the structure *un*-X-*ity* exists just in case *un*-X and X-*ity* exist.

In conclusion, the paradigmatic approach seems to have an advantage in that it can deal successfully with Bracketing Paradoxes. The status of these in Sign-Based Morphology is not clear at this point. One point that may be interesting to notice is that in any given example of Bracketing Paradoxes, only one structure is ever phonologically relevant. For example, for the purposes of phonology, only the structure *un* + *grammaticality* is relevant. The other structure is relevant only for semantic purposes. We

do not find cases where a given word has two different structures motivated such that the phonology needs to make reference to both structures. If this observation is correct, then the right approach to Bracketing Paradoxes may be to use parallel phonological and morphological structures, along the lines of Cohn 1989, Inkelas 1989, and especially Sadock 1991. This possibility has been discussed from an Sign-Based Morphology perspective in Orgun 1994c, Orgun 1995b. More research is needed before any definitive conclusions can be drawn in this area.

Although the strictly paradigmatic approach is in a good position to deal with Bracketing Paradoxes, it does not offer a satisfactory theory of the phonology-morphology interface in that it has no way at all of dealing with cyclic effects. A successful theory of cyclic phonological effects needs to make crucial reference to morphological structure in order to determine which words stand in grammatical correspondence. In Sign-Based Morphology, constructions determine what forms are related. The basis of the strictly paradigmatic approach is its rejection of constituent structures and constructions. From the perspective of this work's focus on the phonology-morphology interface, the Sign-Based Morphology is clearly preferable to the strictly paradigmatic approach, although Bracketing Paradoxes still remain to be investigated.

3.5.6 Comparison of Sign-Based Morphology with loosely paradigmatic approaches and syntagmatic approaches with transderivational identity

At first sight, the loosely paradigmatic approach of Burzio (1994) appears to be fundamentally different from Sign-Based Morphology. I have already shown in section 3.5.4 that Sign-Based Morphology is conceptually quite compatible with a paradigmatic understanding of morphology. In this section, I demonstrate that the loosely paradigmatic approach is the closest one in spirit to Sign-Based Morphology of all paradigmatic approaches to morphology. In fact, once certain minor modifications to remedy some empirical deficiencies of the loosely paradigmatic approach are carried out, it becomes practically indistinguishable from the paradigmatic interpretation of Sign-Based Morphology.

3.5.6.1 Bound complex stems

The first and most obvious, if superficial, difference between Sign-Based Morphology and the loosely paradigmatic approach is that Sign-Based Morphology allows reference to morphologically complex stems that are not independent words, while the loosely paradigmatic approach does not accept the existence of such entities as bound stems. The restriction of reference to independent words is a choice in the loosely paradigmatic approach. This choice can be abandoned at no cost to the theory if empirical evidence requires reference to bound complex stems. Two phenomena that fit this bill have been discussed in the Sign-Based Morphology literature. The first is Cibemba verb stems (Orgun 1995a), discussed in full detail in section 5.6 of this work. The second is Sami passive forms (Dolbey 1996, Dolbey and Orgun 1996). I summarize the main aspects of Sami passive forms here.

The phenomenon of interest is apparent syllable-counting allomorphy in Sami. Essentially, a number of suffixes have two allomorphs such that the first allomorph

attaches to bases that contain an even number of syllables, and the second allomorph to bases containing an odd number of syllables (Dolbey 1996). In (127), syllable boundaries are indicated by periods:

(127)

affix	Even-syllable stem	Odd-syllable stem
	jear.ra 'ask'	veah.ke.hea 'help'
1du	je:r.re-∅	veah.ke.he:-t.ne
2du	jear.ra-beaht.ti	veah.ke.hea-hp.pi
2pl	jear.ra-beh.tet	veah.ke.he:-h.pet
3pl.pret	je:r.re-∅	veah.ke.he:-d.je

For clarity, the even- and odd-number allomorphs of these suffixes are listed in (128):

(128)

affix	Even-syllable stem	Odd-syllable stem
1du	-∅	-tne
2du	-beaht.ti	-hppi
2pl	-behtet	-hpet
3pl.pret	-∅	-dje

Notice that the allomorphs that attach to even-numbered stems themselves contain an even number of syllables. Conversely, the allomorph that attach to odd-numbered stems contain an odd number of syllables. As Dolbey observes, this suggests that the allomorphs are chosen based on the foot pattern of the output. Specifically, the allomorph that allows the output to be exhaustively parsed into binary feet is chosen. Following Kager 1995, Dolbey uses output optimization to account for this allomorphy. The candidate output set includes candidates bearing each allomorph of the appropriate suffix. As usual, the candidate that fares best with respect to the constraint system is the grammatical output. EVAL in this case ends up selecting not just the morphophonemically optimal output, but also the one with the desired allomorph. This is illustrated in the tableaux in (129), taken from Dolbey 1996. The constraint *STRAY-σ rules out syllables not incorporated into binary feet.(feet are enclosed in parentheses in candidate output forms):

(129)

	/jearra, {beahtti ~ hppi}/	*STRAY-σ
☞	(jear.ra)(beaht.ti)	
	(jear.rahp)pi	*!

	/veahkehea, {beahtti ~ hppi}/	*STRAY-σ
☞	(veah.ke)(hea-hp.pi)	
	(veah.ke)(hea.-beaht)ti	*!

As Dolbey shows, the passive affix displays a pattern of allomorphy similar to that found in the person/number affixes shown earlier: a two-syllable allomorph attaches to stems containing an even number of syllables, while a one-syllable allomorph attaches to stems containing an odd number if syllables (130):

(130)

	Even-syllable stem	Odd-syllable stem
Stem	jeɑr.rɑ ‘ask’	veɑh.ke.heɑ ‘help’
Passive	jeːr.ro-juv.vo	veɑh.ke.hu-v.vo

The allomorphs of the passive suffix are shown in (131):

(131)

	Even-syllable stem	Odd-syllable stem
Stem	-juvvo	-vvo

The following tableau shows how the correct form *jeːrro-juvvo* is derived by output optimization (132):

(132)

	/jeɑrrɑ, {juvvo ~ vvo}/	*STRAY-σ
☞	(jeːr.ro)(juv.vo)	
	(jeɑr.ruv)vo	*!

The passive forms in (130) do not occur as independent words. They must be inflected for person and number. Since the person and number affixes (just like the passive affix) have syllable-counting allomorphy, there would appear to be two choices for the ultimate output. In the case of a stem with an even number of syllables, there are two ways in which an exhaustively footed word can be formed: we could choose the monosyllabic allomorph of both suffixes, or the disyllabic allomorph of both suffixes. As Dolbey points out, only the second option is grammatical (133):

(133) *(jeːr.ru)-(v.vo-hp.pi) ‘ask-pass-2du’
(jeːr.ru)-(juv.vo)-(beɑht.ti) ‘ask-pass-2du’

For a stem with an odd number of syllables, an exhaustively footed word could be created by selecting the monosyllabic allomorph of one suffix and the disyllabic allomorph of the other. It turns out that the monosyllabic allomorph of the passive suffix and the disyllabic allomorph of the person/number suffix must be chosen. It is not possible to use the disyllabic allomorph of the passive suffix and the monosyllabic allomorph of the person/number suffix (134):

(134) (veɑh.ke)(hu-v.vo)-(beɑht.ti) ‘help-pass-2du’
*(veɑh.ke)(heɑ.-juv)(vo-hp.pi) ‘help-pass-2du’

According to Dolbey's analysis, the passive stem in Sami is subject to exhaustive footing on its own, as shown in (130). Grammatical and ungrammatical passive stems are shown in (135):

(135)	(veɑh.ke)(hu-v.vo)	'help-pass'
	*(veɑh.ke)(heɑ-juv)vo	'help-pass'
	(jeːr.ru)-(juv.vo)	'ask-pass'
	*(jeːr.ru)-v.vo	'ask-pass'

It is to the grammatical stems in (135) that the person/number affixes must be added. Since the grammatical stems necessarily contain an even number of syllables (because they are subject to optimization in this regard), it follows that they will always combine with the disyllabic allomorphs of the person/number suffixes. Thus, a satisfactory analysis of Sami morphology must be based on correspondence constraints between passive stems and words. Since the passive stems cannot occur as words on their own, but must take obligatory person/number affixes, the claim that all correspondence constraints must hold between independent words is falsified, as observed by Dolbey and Orgun (1996).

The claim in the loosely paradigmatic approach that all correspondence constraints hold between words is identical to the claim by Aronoff 1976 that all morphology is word-based. Aronoff himself has since abandoned this claim, replacing it with the weaker but empirically more adequate claim that morphology is stem-based (Aronoff 1994; also Anderson 1992). The Sign-Based Morphology position is equivalent to stem-based morphology. The demonstration in this section shows that the loosely paradigmatic approach has to abandon word-based morphology in favor of stem-based morphology as well.

(136) Stem-based morphology: Correspondence constraints hold between stems (lexical entries) which may or may not be independent words.

Another compelling case of constraints holding on a morphologically bound stem is found in Cibemba (Hyman 1994). This case is discussed in detail in section 5.6.

Abandoning the stipulation that all correspondence constraints hold between words solves another problem that the loosely paradigmatic approach faces. This problem has to do with stems that seem to have the same morphological structure as independent words (that is, they contain the same morpheme), but are nonetheless not subject to some phonological constraints that words are subject to. A good example of this phenomenon is found in Lardil, where word-final vowels and non-coronal consonants are deleted (Hale 1973).

(137)

absolute	inflected	gloss
ŋalu	ŋaluk-in	‘story’
tʰurara	tʰurarəŋ-in	‘shark’
pirŋen	pirŋen-in	‘woman’
majar	majar-in	‘rainbow’
jarput	jarput-in	‘snake’
waŋal	waŋal-in	‘boomerang’
jalul	jalulu-n	‘flame’
majar	majara-n	‘rainbow’
jilijil	jilijil-in	‘oyster’
wiwal	wiwala-n	‘mango’
karikar	karikar-in	‘butter fish’
jukar	jukarpa-n	‘husband’
karawakar	karawakarwa-n	‘wattle’
putu	putuka-n	‘short’
murkuni	murkunima-n	‘nullah’
tipiti	tipitip-in	‘rock cod’
turara	turarəŋ-in	‘shark’

The loosely paradigmatic approach does not face any particular difficulties in deriving the absolute form of words in Lardil. Since monomorphemic words are derived from their underlying form, the derivation is identical to a traditional generative one:

(138)

UR	murkunima
	↓
Surface	murkuni

The word-basedness hypothesis makes it impossible to derive the inflected form, however. According to the hypothesis, the inflected form must be derived from the independent surface absolute form by the addition of the affix *-in*. It is therefore impossible to recover the lost underlying root-final segments (139):

(139)

$Word_1$:	murkuni
$Word_2$ = [$Word_1$ + affix]:	murkuni + in
Predicted surface form:	*murkunin

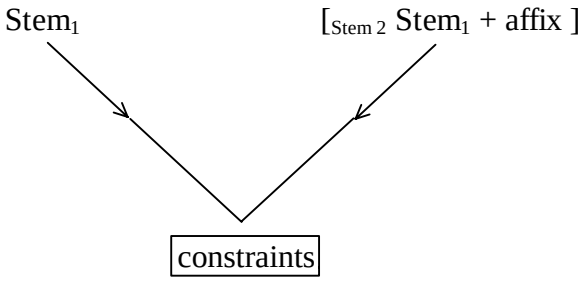
Abandoning the word-based hypothesis allows the loosely paradigmatic approach to offer an analysis of these Lardil forms: the absolute stem is identical to the underlying root. The inflected stem is formed by adding the suffix *-in* to the underlying root. The absolute stem and the inflected stem may both undergo a word construction (140):

(140)

Absolute form		Inflected form	
UR:	murkunimɑ	UR:	murkunimɑ
Word:	murkuni	Inflected stem:	murkunimɑn
		Word:	murkunimɑn

Thus, even when a particular combination of morphemes may stand alone as an independent word, stem-based rather than word-based morphology may be called for. Thus, the word-based representation of paradigmatic relations that Burzio proposes (111) should be replaced by the stem-based interpretation in (141):

(141)



In addition to (141), we also need constructions for compounding, nonconcatenative morphology, and a word construction that forms words from (some but not necessarily all) stems.

3.5.6.2 Noncyclic effects

Another aspect in which Sign-Based Morphology differs from the loosely paradigmatic approach is its construction-based orientation. The depiction of the loosely paradigmatic approach in (141) implies that correspondence constraints hold between any pair of stems that differ by one morpheme. This interpretation is unable to deal with noncyclic phonological effects, however. Consider, for example, subminimal verbal forms in Turkish (section 2.1), which can be repaired by adding tense/aspect suffixes (142):

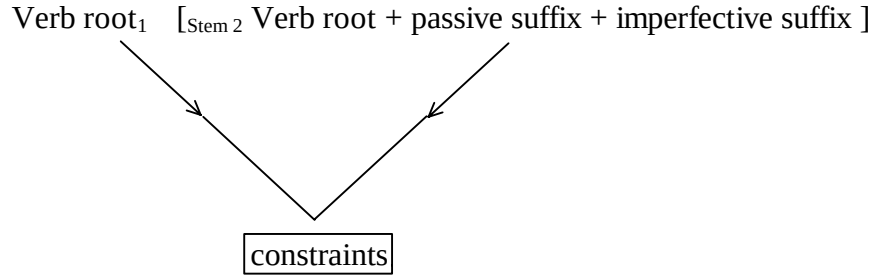
(142)

Form	Gloss	Comments
je	'eat'	Roots not subject to disyllabic minimality
*je-n	'eat-pass'	Subminimal suffixed form
je-n-ir	'eat-pass-imprf'	Total size is two syllables

According to the system in (141), the passive imperfective form must stand in correspondence with the passive form, not with the root. This, however, incorrectly predicts the passive imperfective form to be ungrammatical. The problem here is that the paradigmatic correspondence is assumed to be automatic in the loosely paradigmatic approach: whenever two stems exist that differ in only one morpheme, they stand in correspondence. In Sign-Based Morphology, on the other hand, the correspondence relation is construction-oriented. Two stems stand in correspondence if and only if there is

a grammatical construction that explicitly allows such a correspondence relation. This property of Sign-Based Morphology has two desirable consequences. First, it eliminates unwanted correspondences. In Turkish, for example, passive forms are prevented from standing in correspondence with passive imperative forms by not including a construction in the grammar that sanctions such a correspondence. Second, stems that differ by more than one morpheme may be allowed to stand in correspondence by including grammatical constructions that sanction such a situation. For example, in Turkish, bare roots can stand in correspondence with passive imperfective forms, thanks to a grammatical construction that sanctions this (143):

(143)



Thus, paradigmatic correspondences should not be defined automatically from linear strings of morphemes, but rather should be explicitly sanctioned by grammatical constructions.

3.5.6.3 Inside-out effects

As mentioned earlier, one of the fundamental properties of cyclic phonological effects is their inside-out nature. That is, in synchronic morphology it is always morphologically simpler forms that exert a phonological influence on more complex forms, never vice versa. This contrasts with paradigmatic effects in diachronic change, which may very well be outside-in. Since the loosely paradigmatic approach assumes the correspondence relation to be symmetric, how does it account for the inside-out nature of cyclic effects? In this section, I discuss the status of these effects in the loosely paradigmatic approach as well as the syntagmatic approach enriched with transderivational identity. The Italian example I use comes from Kenstowicz's (1995) work, which assumes the syntagmatic approach enriched with transderivational identity. However, the discussion applies to the loosely paradigmatic approach as well: the only difference between the two approaches is that the syntagmatic approach allows reference to the full underlying string for each word in addition to allowing correspondence constraints between words, whereas the paradigmatic approach lacks the former mechanism. This additional mechanism is not crucially used in Kenstowicz's analysis of Italian.[33] The demonstration below is therefore equally valid for the loosely paradigmatic approach, which possesses all and only the mechanisms used in the analysis.

33 Nor has this additional tool been used in any analysis in the literature. It is therefore not clear that this excess power is justified.

I first illustrate the syntagmatic approach enriched with transderivational identity in more detail by summarizing Kenstowicz's (1995) Optimality Theoretic analysis of Northern Italian s-voicing, based on data discussed by Nespor and Vogel (1986). In the relevant dialects, [s] and [z] are in complementary distribution, with [z] appearing intervocalically:[34]

(144)	azola	'button hole'
	azilo	'nursery school'
	kaz-a	'house'
	kaz-ina	'house-dim'

As noted by Nespor and Vogel, s-voicing does not apply consistently across morpheme boundaries. The rule applies in (145a,c), but not in (145b):

(145)	a)	diz-onesto	'dishonest'
		diz-uguale	'unequal'
	b)	a-sotʃale	'asocial'
		bi-sessuale	'bisexual'
		ri-suonare	'to ring again'
		pre-sentire	'to hear in advance'
	c)	re-zistentsa	'resistance'
		pre-zentire	'to have a presentiment'

Kenstowicz claims, following Nespor and Vogel, that the failure of s-voicing to apply in (145b) is connected to the fact that the stem is an independent word in these forms. The contrast between *rezistentsa* and *asotʃale* is to be explained by the fact that the stem is an independent word in the latter but not in the former.[35] In the paradigmatic approach, this idea is implemented by invoking correspondence constraints between related words. Thus, identity constraints are enforced between *sotʃale* and *asotʃale*. By ranking the identity constraints higher than the phonotactic constraint responsible for s-voicing, the failure of voicing to apply to *asotʃale* can be accounted for. Kenstowicz formulates his analysis of Italian s-voicing in terms of Optimality Theory (Prince and Smolensky 1993).

34 The Italian data, like all data in this work, are presented in IPA. Thus, [s] is a voiceless alveolar fricative and [z], its voiced counterpart.

35 This difference between bound and free morphs was noted by Kiparsky 1982, who proposed to account for it by assuming that free morphs undergo a root cycle while bound morphs do not (see also Inkelas 1990). Kiparsky's approach (although stipulative) has greater empirical success than the paradigmatic approach. This is because morphologically complex stems are always cyclic domains, even when they are not possible words. See Orgun 1994c, 1995a for discussion of this issue from a Sign-Based Morphology perspective.

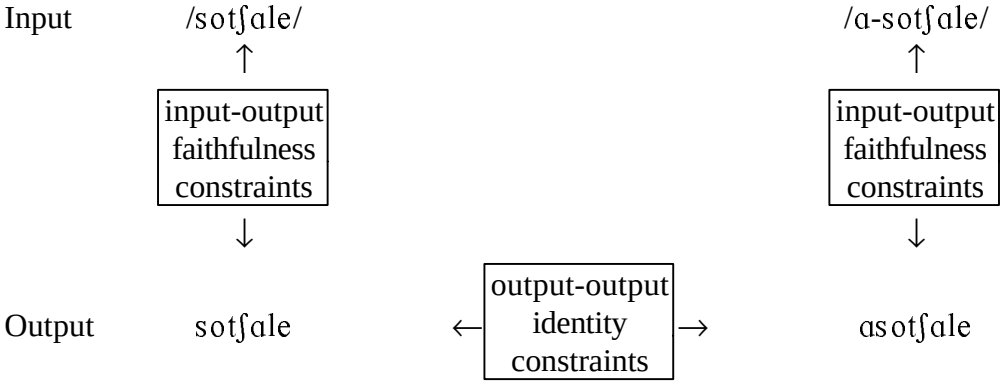
The tableau in (146) shows how the correct surface form [ɑzolɑ] is derived from the input form /ɑsolɑ/. This tableau establishes a crucial constraint ranking, namely that faithfulness to input (FAITH) is outranked by the phonotactic constraint responsible for s-voicing (VzV)—otherwise, the predicted output for the given input would be *[ɑsolɑ].

(146)

/ɑsolɑ/	VzV	FAITH
[ɑsolɑ]	*!	
☞ [ɑzolɑ]		*

Having established the crucial constraint ranking VzV»FAITH, I now return to the alleged paradigm uniformity effect responsible for the failure of s-voicing to apply in [ɑsotʃɑle]. The diagram in (147) illustrates the usual input-output relation and the novel paradigm uniformity relation at work:

(147)



If we just had the usual input-output constraint system, we would incorrectly predict *[ɑzotʃɑle], since we have already established that intervocalic s-voicing is more important that faithfulness to the input. Output-output identity constraints require morphologically related forms to be phonologically similar. In this case, one of the requirements imposed by an output-output constraint is that continuants in related forms must agree in voicing. This constraint must outrank s-voicing to prevent it from applying in [ɑsotʃɑle]. This ranking and the derivation of [sotʃɑle] and [ɑsotʃɑle] are illustrated in the tableau in (148):

(148)

/sotʃɑle/, /ɑ-sotʃɑle/	O-O IDENT	VzV	FAITH
[sotʃɑle], [ɑzotʃɑle]	*!		*
☞ [sotʃɑle], [ɑsotʃɑle]		*	

Output-output identity prevents s-voicing to apply to the morphologically derived form [ɑsotʃɑle]. In the case of *dizonesto*, *dis* is not an independent word. Therefore, no paradigmatic correspondence constraints apply. There is nothing to block s-voicing.[36]

Unfortunately, the constraint system in its present form predicts the pair *[zotʃɑle], *[ɑzotʃɑle] to be the winner. This is illustrated in (149):

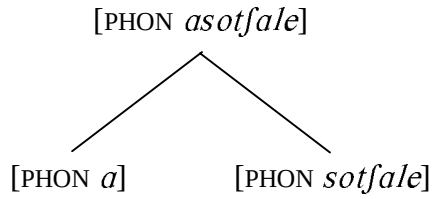
(149)

/sotʃɑle/, /ɑ-sotʃɑle/		O-O IDENT	VzV	FAITH
	[sotʃɑle], [ɑzotʃɑle]	*!		*
(☞)	[sotʃɑle], [ɑsotʃɑle]		*!	
💣	[zotʃɑle], [ɑzotʃɑle]			**

It is not a trivial matter to undo this unfortunate prediction. Kenstowicz proposes a principle of "base identity" to deal with this issue. This principle amounts to stipulation to the effect that the "base" (morphological input) form is not altered in response to output-output identity constraints. Benua 1996 takes a more indirect, ingenious route. According to her proposal, two copies of the constraint system are in effect in an evaluation of a morphologically related pair. One copy is enforced on the base, and the other copy is enforced on the derived form. Benua stipulates that all the constraints that apply to the base outrank all the constraints that apply to the derived form. It follows that the base will never be influenced by the derived form, but the derived form may be influenced by the base. I will not dwell on the details of these proposals here, except to note that they are both unmotivated stipulations that do not follow in any way from any aspect of the theory. They are designed simply to mimic the effects of a cyclic derivation. To make matters worse, both approaches have global power, allowing full reference to the underlying forms of the morphemes involved as well as the surface form of the base. By contrast, the inside-out nature of interleaving effects, which Benua and Kenstowicz's stipulations are designed to encode, follows as a direct consequence of the basic architecture of Sign-Based Morphology, where the derived form cannot have an effect on the base simply because it is not part of the constituent structure representation of the base. I illustrate this by presenting sign-based representations of the crucial Italian forms. The derived form [ɑ-sotʃɑle] has the constituent structure in (150):

36 This account cannot, however, handle the contrast between [presentire] and [prezentire], which both (presumably) involve the same stem [sentire], which occurs independently as a word on its own. In Lexical Phonology terms, this contrast is accounted by invoking a pre-affixal stem cycle in one case but not the other. See Inkelas 1990 for details of this idea. In Sign-Based Morphology, this can be handled by enforcing phonological constraints on the daughter node of constructions. See Stump 1995 and Orgun 1995d for discussion of this possibility.

(150)



As in Kenstowicz's account, identity to the "base" (that is, the daughter node *sotʃale*) must outrank the phonotactic constraint VzV. Obviously, the base may have a phonological effect on the derived form, since the base is a subconstituent of the derived form. There is no need to stipulate the existence of identity constraints holding between morphologically related forms. Relatedness is already encoded by the constituent structure, as in almost all linguistic theories. The constituent structure of the "base" form *sotʃale* is shown in (151):

(151) [PHON *sotʃale*]

Obviously, there is no way that the derived form could exert any phonological influence on the base form. The derived form is not part of the morphological representation of the base form. This is a direct consequence of using constituent structures, which even authors like Benua, Kenstowicz, and McCarthy seem to implicitly assume. To recapitulate, the inside-out nature of interleaving effects is an integral part of Sign-Based Morphology. The phonology-morphology interface could not have been any other way given the framework. In the paradigmatic approach, this most basic property (which has also formed the basis of the framework of Lexical Phonology) is handled by an awkward stipulation.

We have seen how the inside-out nature of cyclic effects follows from the syntagmatic interpretation of Sign-Based Morphology. Since the goal of this section is to explore the connection between Sign-Based Morphology and paradigmatic approaches to morphology, I turn to the status of inside-out effects from the perspective of the paradigmatic interpretation of Sign-Based Morphology. The paradigmatic interpretation of Sign-Based Morphology is based on licensing statements of the sort in (152):

(152) Unary construction (e.g., affixation, zero derivation, etc.):

$Sign_2$ is wellformed iff:
- i) $Sign_1$ is wellformed, and
- ii) The grammar contains a relation $\mathfrak{R}$ such that $\mathfrak{R}(Sign_1, Sign_2)$

Binary construction (e.g., compounding)

$Sign_3$ is wellformed iff:
- i) $Sign_1$ and $Sign_2$ are wellformed, and
- ii) The grammar contains a relation $\mathfrak{R}$ such that $\mathfrak{R}(Sign_1, Sign_2, Sign_3)$

etc.

The inside-out nature of interleaving effects follows as a direct consequence of such licensing statements. To make this point explicit, let us consider the Turkish disyllabic minimal size condition, which provides a rather striking illustration of the need to restrict cyclic phonological effects to be inside-out. For nominal forms in Turkish, the situation is summarized in (153):

(153)

Form	Gloss	Comments
doː	'note C'	Disyllabic minimality not enforced on roots
*doː-m	'C-1sg.poss'	Subminimal form
*doː-m-u	'C-1sg.poss-acc'	Supraminimal, but ungrammatical because related form **doː-m* is ungrammatical
sol^{j}	'note G'	Disyllabic minimality not enforced on roots
sol^{j}-ym	'G-1sg.poss'	Supraminimal, therefore grammatical
sol^{j}-ym-y	'G-1sg.poss-acc'	Grammatical, because related form *sol^{j}-ym-y* is grammatical

Let us first consider how *sol^{j}-ym-y* 'my G-acc' is licensed. The licensing statement for this form is shown in (154), where the stem that this form is to be grammatically related to is (correctly) identified as *sol^{j}-ym* 'G-1sg.poss':

(154) *sol^{j}-ym-y* is wellformed if and only if:

i) *sol^{j}-ym* is wellformed, and
ii) There is a grammatical relation $\Re$ such that $\Re$(*sol^{j}-ym, sol^{j}-ym-y*)

Clause (ii) is satisfied, since there *is* a grammatical relation (namely the accusative construction) that has the desired property. We must check that clause (i) is also satisfied. To do this, we must consider the licensing statement for the form *sol^{j}-ym* (155):

(155) *sol^{j}-ym* is wellformed if and only if:

i) *sol^{j}* is wellformed, and
ii) There is a grammatical relation $\Re$ such that $\Re$(*sol^{j}, sol^{j}-ym*)

Clause (i) is satisfied, because *sol*^{j} is wellformed by virtue of being a lexical entry (an underlying form). Clause (ii) is also satisfied: the first person possessive construction is the desired relation.

Let us turn to the ungrammatical form **do:-m-u* 'C-1sg.poss-acc'. The licensing statement form this form is shown in (156):

(156) *do:-m-u* is wellformed if and only if:
- i) *do:-m* is wellformed, and
- ii) There is a grammatical relation ℜ such that ℜ(*do:-m*, *do:-m-u*)

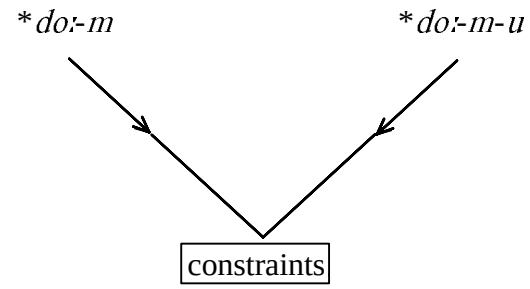
Clause (ii) is once again satisfied: the accusative construction is the relation we need. To check whether clause (i) is satisfied, we must consider the licensing statement for *do:-m* 'C-1sg.poss' (157):

(157) *do:-m* is wellformed if and only if:
- i) *do:* is wellformed, and
- ii) There is a grammatical relation ℜ such that ℜ(*do:*, *do:-m*)

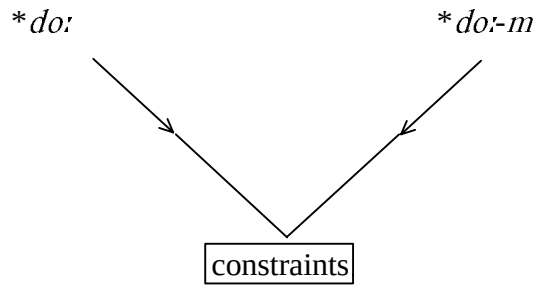
Clause (i) is satisfied: *do:* 'C' is a lexical entry (underlying form). Clause (ii), however, is not satisfied: ℜ(*do:*, *do:-m*) does *not* hold, since the second argument is monosyllabic (suffixed forms must be disyllabic). Therefore, **do:-m-u* 'C-1sg.poss-acc' is ungrammatical. The bare form *do:* 'C' is licensed in the following manner: there is a lexical entry *do:*, and there is a relation (namely the word construction) such that ℜ(*do:*, *do:*).[37] It is clear that outside-in effects are not possible under this licensing interpretation of paradigmatic correspondence. The pitfall that the symmetric interpretation of paradigmatic correspondence is subject to is illustrated below:

37 The word construction has not received much attention in this work, but the need for it is demonstrated quite clearly by the Lardil example discussed in the preceding section.

(158) i) Desired paradigmatic relation:



ii) Undesired paradigmatic relation:



In (i), *do:-m-u is ungrammatical because it stands in correspondence with *do:-m. In (ii), do: is ungrammatical because it stands in correspondence with *do:-m. If the paradigmatic relation is symmetric, there is no way to avoid this incorrect prediction. The licensing approach avoids this problem, as demonstrated above.

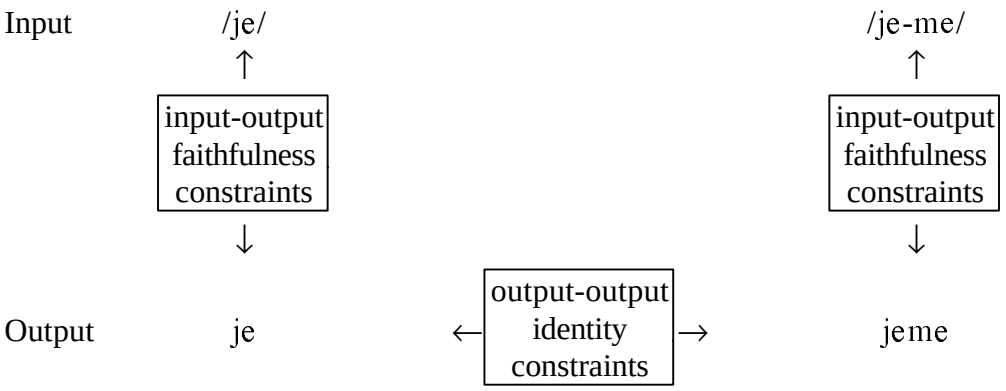
Thus, the paradigmatic approach needs to be based on licensing in order to deal with the inside-out nature of cyclic effects. There is no need for arbitrary and unmotivated stipulations like the primacy of the base or recursion of CON once a licensing-based approach is adopted. Since such an approach is required independently by the construction orientation (necessary to deal with noncyclic effects), the paradigmatic approach loses nothing by adopting it.

3.5.7 Level economy in the paradigmatic approach

Level Economy is the name given by Inkelas and Orgun (1995) to the principle that, contrary to the standard model in Lexical Phonology, forms only undergo phonology on those lexical levels where they undergo morphology. We will see in section 4.7.2 that level economy effects result in Sign-Based Morphology from the fact that phonological constraints are imposed on each node in a constituent structure. When a construct lacks a morpheme of a particular level, there is no node in the constituent structure that is subject to the phonological constraints of that level. This situation is, by definition, Level Economy. In the paradigmatic approach, level economy effects follow in more or less the same manner. Given a form like the Turkish *je-me* 'eat-neg.imper', correspondences would be set up between this form and the bare verb form *je* 'eat' (also a possible word,

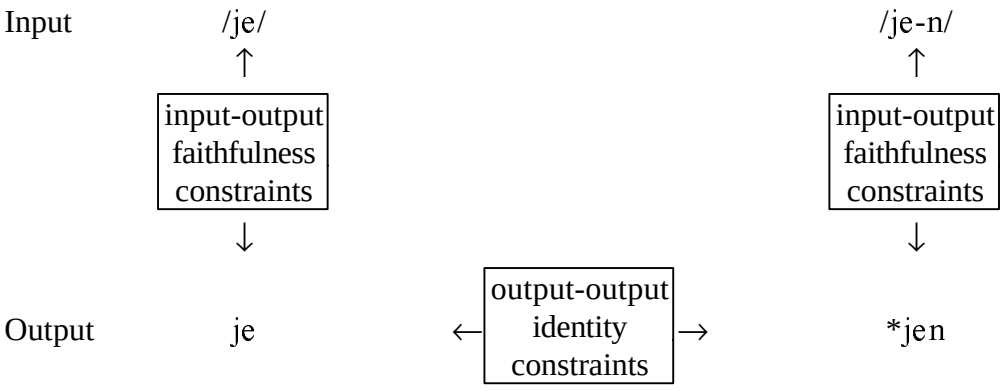
but incorrectly predicted to be ungrammatical by standard Lexical Phonology with level ordering, since every word goes through every stratum of the lexical phonology[38]), in addition to the regular input output correspondences. This is shown in (159):

(159)



The input output constraints for *je* 'eat' do not include disyllabic minimality, a constraint that is not imposed on roots. Whether or not the constraints imposed on *je-me* 'eat-neg.imper' include disyllabic minimality, this form is going to be grammatical, since it contains the requisite number of syllables. There is no reason to expect the bare verb root *je* 'eat' to be (incorrectly) subject to level 1 constraints (those associated with the passive suffix), one of which, namely the minimal size constraint, it would violate. For comparison, the constraint layout for **je-n* 'eat-passive' is shown in (160):

(160)



Here, the submininal form **je-n* 'eat-pass' is ungrammatical because it violates the minimal size condition. I conclude therefore that the paradigmatic approach is just as successful as Sign-Based Morphology in handling Level Economy effects. Level Economy

38 Although Itô 1990 suggests that the immunity of underived forms from prosodic minimality might be due to the Strict Cycle Condition, Inkelas and Orgun 1995 show that this cannot be a general explanation, since nonderived roots in Turkish (and also in Latin, Mester 1995) are subject to another, bimoraic, minimal size condition.

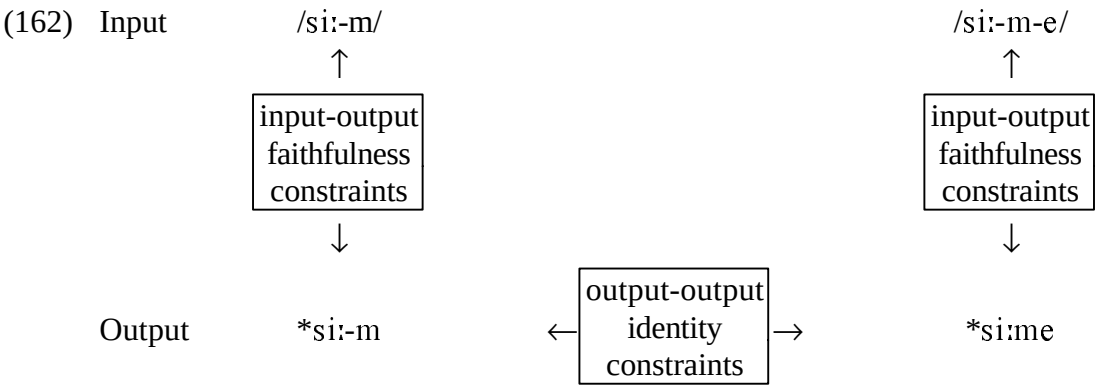
does not distinguish Sign-Based Morphology empirically from paradigmatic approaches to morphology.

3.5.8 Noncyclic phonological effects in the syntagmatic approach with transderivational identity

In this section, I will examine the status of noncyclic phonological effects in the paradigmatic approach. But first, let us look at how the apparent cyclic enforcement of the Turkish disyllabic minimal size condition in nominal forms is handled. The basic data are presented in (161):

(161) si: 'musical note B'
*si:-m 'B-1sg.poss'
*si:-m-e 'B-1sg.poss-dat'

The ungrammaticality of the disyllabic form **si:-m-e* 'B-1sg.poss-dat' suggests that the minimal size condition is enforced cyclically, that is, that the morphological subconstituent **si:-m* must be subject to phonology on its own as a phonological domain excluding the case suffix *-e*. The correspondence relations are set up in (162) (I omit the bare root form *si:* 'musical note B' for conciseness; it is irrelevant to the issue at hand):



There are several difficulties in interpreting this diagram. First, recall that the proponents of the paradigmatic approach stipulate paradigm uniformity constraints to hold only between "surface" or "output" forms of existing lexical items. It is not clear in what sense there could be a "surface" form in the Turkish lexicon corresponding to the ungrammatical **si:-m* 'B-1sg.poss'. A more natural position to take regarding ungrammaticality would be to say that there is no such lexical entry, rather than saying that there is such an entry listed in the Turkish lexicon, which comes with some sort of ungrammaticality tag that prevents it from being used. Even if the latter were allowed, it is not clear in what sense this item could be considered a surface form. It should be noted, however, that the restriction of paradigm uniformity constraints to surface forms only is a stipulation that in no way follows from any aspect of the theory. It can therefore be abandoned at no cost. In fact, Dolbey 1996, Dolbey and Orgun 1996 have argued that this stipulation must be

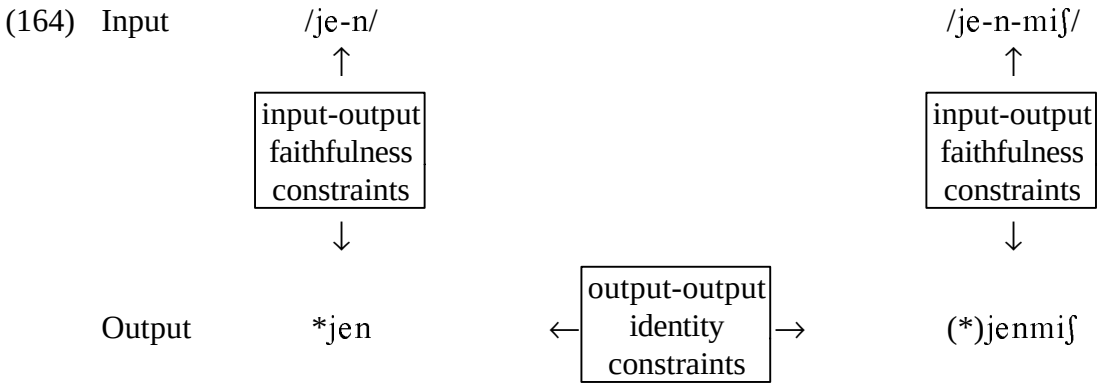
abandoned in light of the crosslinguistically attested phenomenon of morphologically bound stems that act as cyclic phonological domains (Dolbey and Orgun's examples come from Cibemba and Sami; the Cibemba example is discussed in section 5.6 of this study).

Even then, however, problems remain. Output-output constraints are generally, and doubtless rightly, understood to require the phonological shape of the morphologically derived form to be similar to the phonological shape of the "base". In Italian, for example, base and derived form continuants are required to agree in voicing. Now, ungrammaticality is surely not a phonological feature alongside with voicing, metrical structure, and so on. How is it then that output-output identity constraints cause the derived form to inherit ungrammaticality from the base **si:-m* 'B-1sg.poss'?

Even if treating ungrammaticality as a property that might be enforced by an output-output constraint to be shared between a base form and a derived form is allowed, problems still remain. The apparent noncyclic enforcement of the minimal size condition in verbal forms must still be handled. The basic data are repeated in (163):

(163) je 'eat'
*je-n 'eat-pass'
je-n-miʃ 'eat-pass-evid'

Whatever criterion is used by the paradigmatic approach to determine lexical relatedness (this is not made explicit by any of the authors whose work has been cited) must surely treat *je-n* 'eat-pass' and *je-n-miʃ* 'eat-pass-evid' as related. The relative configuration of this pair is identical to that of the nominal pair *si:-m* 'B-1sg.poss' and *si:-m-e* 'B-1sg.poss-dat'. Since the latter count as related, so must the former.[39] We thus have the following pattern of correspondence constraints:



What is to prevent ungrammaticality to be inherited by the derived form in this case? The problem is that preventing ungrammaticality to be inherited is not the issue here. The two

39 Unless the criterion for relatedness is morphological subconstituency, as in Sign-Based Morphology. But in that case there is no need to stipulate paradigm uniformity constraints to begin with, as Sign-Based Morphology already handles all the relevant data by using no other tools than constituent structure.

forms in (164) must not stand in any sort of correspondence relation at all. The paradigmatic approach seems to have no way of handling noncyclic phonological effects. The only solution seems to be to use different constraint rankings in different paradigms, a move that Benua 1996 explicitly rejects. This move would bring the paradigmatic approach even closer to Sign-Based Morphology: the need for constructions was already motivated in section 3.5.6.2. Allowing different constructions to be associated with different constraint rankings amounts to using cophonologies, a hallmark of Sign-Based Morphology.

This deficiency is not restricted to cases where ungrammaticality is involved. Straightforward phonological alternations pose the same problem, as I show by considering Ondarroa Basque vowel height assimilation. Recall that vowel height assimilation applies crucially noncyclically in Ondarroa Basque. The relevant data are repeated in (165):

(165)

mutiʎ	'boy'	
mutiʎ-e	'the boy'	
mutiʎ-ɑ-k	'the boy-erg.'	*mutiʎ-e-k

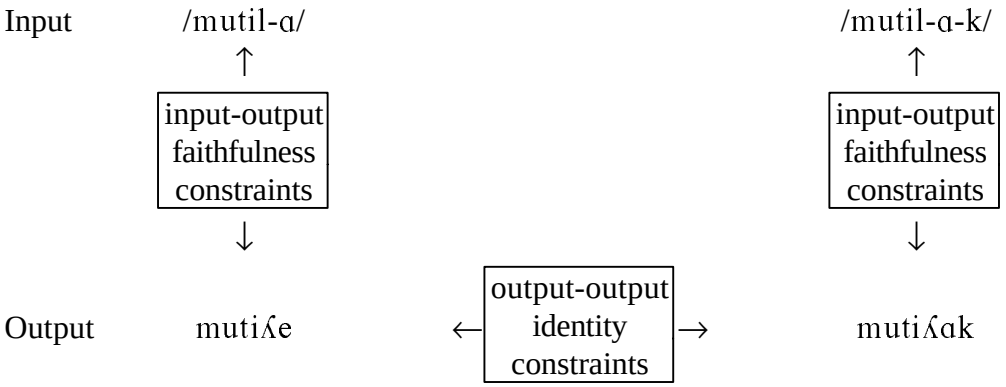
The fact that [ɑ] raises to [e] at all means that the constraint responsible for height assimilation (which I will call SHARE [-low]) must outrank the competing input-output faithfulness constraint (FAITH [a]). This is shown in the tableau in (166):

(166)

/mutil-ɑ/	SHARE [-low]	FAITH [ɑ]
mutiʎɑ	*!	
☞ mutiʎe		*

The correspondence relations between *mutiʎ-e* 'the boy' and *mutiʎ-ɑ-k* 'the boy-erg' are set up as shown in (167):

(167)



The fact that the definite article suffix vowel [ɑ] in *mutiʎ-ɑ-k* 'the boy-erg' is faithful to its underlying form instead of copying the [e] in the base form *mutiʎ-e* 'the boy' requires

us to posit that faithfulness (FAITH [ɑ]) is ranked higher that output-output identity (IDENT [ɑ]). This is shown in the tableau in (168):

(168)

/mutil-ɑ/, /mutil-ɑ-k/	SHARE [-low]	FAITH [a]	IDENT [a]
[mutiʎe], [mutiʎek]		**!	
☞ [mutiʎe], [mutiʎɑk]		*	*
[mutiʎɑ], [mutiʎɑk]	*!		

Apparent noncyclic effects are handled by the paradigmatic approach in a way that differs greatly from the way they are handled in Sign-Based Morphology. In Sign-Based Morphology, flat structures give rise to noncyclic phonological effects. This means that there is no intermediate stem to refer to in noncyclic structures. In (168), *mutiʎ-e* 'the boy' would have no part at all in the derivation of *mutiʎ-ɑ-k* 'the boy-erg'. In the paradigmatic approach, the intermediate stem is still there, but cyclic effects are averted by utilizing the global power of the theory that allows reference to the underlying form of the morphemes involved, as well as to the surface form of the base. This approach thus predicts that cyclic and noncyclic phonological effects can coexist within a single derived form when more than one phonological alternation is involved. In the absence of positive evidence for this extra power, the more restrictive framework of Sign-Based Morphology, which does not allow cyclic and noncyclic phonological effects to be found in a single form, must be preferred.

(169)

Output-output correspondence	Sign-Based Morphology
Predicts "process-specific cyclicity", that is, a given form exhibiting cyclic phonological effects with respect to some alternations and noncyclic effects with respect to other alternations. Such effects are not attested.	Disallows process-specific cyclicity. Cyclic effects follow from branching structures, and noncyclic effects, from flat structures. The two cannot coexist.

Cyclic and noncyclic effects *can*, however, coexist within one language. In fact, the very same alternation may be observed as applying cyclically in some forms and noncyclically in others. The Turkish minimal size condition is a case in point. Basque height assimilation is another. Recall now that vowel height assimilation in Ondarroa Basque may apply cyclically under the right morphological conditions. The relevant data are repeated in (170):

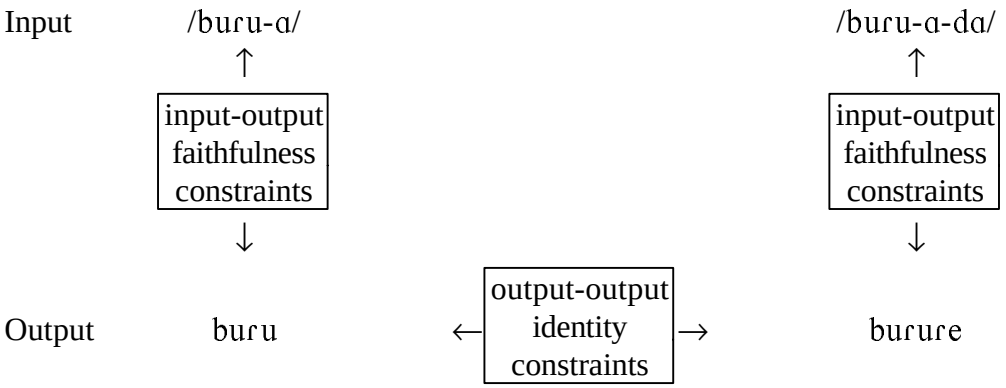
(170) a)

/buru-ɑ-dɑ/	[burure]	'it is the head'
/bɑso-ɑ-dɑ/	[bɑsure]	'it is the forest'

b)	/lagun-ɑ-dɑ/	[layunerɑ]	'it is the friend'
	/mendi-ɑ-dɑ/	[mendiʃerɑ]	'it is the mountain'

The data in (170a) do not pose any challenge to the paradigmatic approach. The correspondence relations are as shown in (171):

(171)



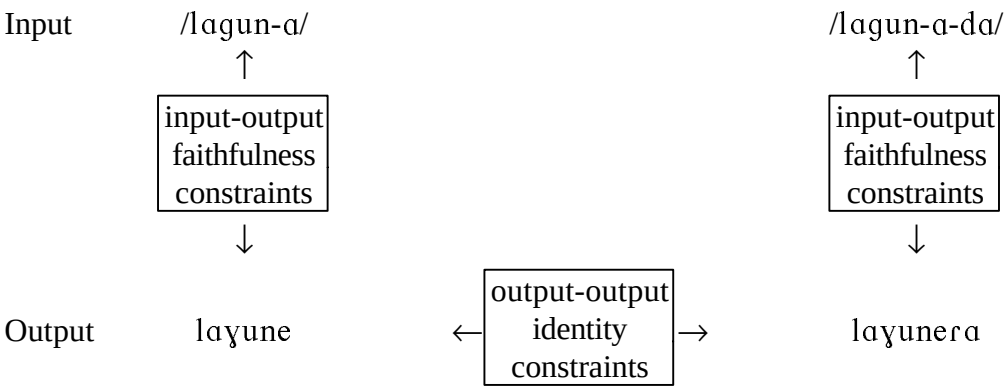
The constraint ranking we have already established handles these forms successfully, as shown in (172):

(172)

/buru-ɑ/, /buru-ɑ-dɑ/	SHARE [-low]	FAITH [a]	IDENT [a]
[buru], [burura]	*!		
☞ [buru], [burure]		*	

The data in (170b) prove to be more problematic, however. The correspondence relations are shown in (173):

(173)



In this case, the constraint ranking we have already established incorrectly predicts the derived form to fail to undergo vowel height assimilation, yielding *[layunarɑ] instead of the correct form [layunerɑ]. This is shown in the tableau in (174):

(174)

/lagun-a/, /lagun-a-da/	SHARE [+low]	FAITH [a]	IDENT [a]
💣 [layune], [layunara]		*	*
(☞) [layune], [layunera]		**!	
[layuna], [layunara]	*!		

Comparison of (174) with (172) makes it clear that it is impossible for the paradigmatic approach to handle both the cyclic and the noncyclic cases. The relative configurations of the base and derived forms are identical in the two groups of data, as made more explicit in (175):

(175)

Root	Base form	Derived form
/mutil/	/mutil-a/	/mutil-a-k/
/lagun/	/lagun-a/	/lagun-a-da/

In both examples, the base form satisfies the environment for vowel height assimilation, and therefore undergoes it. The resulting [e] is copied to the derived form in one case, but not the other. Adjusting the relative ranking of faithfulness to input and output-output identity is clearly not the right approach. Instead, the morphological constituent structure must be referred to, as in Sign-Based Morphology. This solution is of course available within the paradigmatic approach as well, by shifting to a construction-oriented approach as suggested in section 3.5.6.2.

Assuming different constraint rankings for forms with suffixes and clitics is another possible solution. This solution is available in the syntagmatic approach, which has the full underlying form available, but not in the loosely paradigmatic approach, which can only refer to a related stem. The construction-oriented solution is preferable, since it uses fewer mechanisms. In particular, since there is no demonstrated need for the global power of referring to the underlying form of complex words, the more restrictive loosely paradigmatic approaches appears to be preferable.

3.5.9 Summary of the paradigmatic aspect of Sign-Based Morphology

I have classified paradigmatic approaches to morphology into three main categories: strictly paradigmatic approaches, loosely paradigmatic approaches, and syntagmatic approaches with transderivational identity. Of these, the strictly paradigmatic approach is unable in principle to deal with cyclic phonological effects (as admitted by Bochner 1993). The remaining two are quite similar to each other. They possess exactly the same set of mechanisms, except that the syntagmatic approaches has the additional power of global reference to underlying forms. This additional tool amounts to abandoning Bracket Erasure (Pesetsky 1979, Kiparsky 1982). Since this global power does not seem to be empirically justified (note that this added flexibility has in fact not been *used* by Benua, Kenstowicz, or McCarthy), the loosely paradigmatic approach seems to be the theory of choice among paradigmatic approaches to morphology.

The loosely paradigmatic approach is quite similar to Sign-Based Morphology in spirit. As defined by Burzio (1994), it suffers from a number of empirical problems, which

can, however, be remedied quite easily, and in a principled manner, by incorporating insights from Sign-Based Morphology. These are summarized in below.

- Stem-based morphology: correspondence constraints relate lexical entries (stems), which may or may not be independent words.
- Construction orientation: Two stems stand in grammatical correspondence if and only if such correspondence is sanctioned explicitly by a grammatical construction.
- Licensing: Grammatical correspondence constraints are licensing statements. A stem ($Stem_n$) is licensed if:
    a) It is an underlying form, or
    b) $Stem_1$, $Stem_2$, … , $Stem_{n-1}$ are licensed, and there is a grammatical relation $\Re$ such that $\Re$($Stem_1$, $Stem_2$, … , $Stem_{n-1}$, $Stem_n$) holds.

Stem-based morphology is required because morphologically bound stems must be referred to by grammatical constraints. Construction orientation is necessary to deal with noncyclic phonological effects. Licensing accounts for the inside-out nature of cyclic phonological effects. All these are inherent properties of the sign-based architecture. Sign-Based Morphology is therefore a loosely paradigmatic approach with just the right properties.