4: Word Formation Rules

Merely to say that words are formed from words is neither novel nor enlightening. To make the statement interesting, we must be able to make more precise claims about the nature of the rules which generate words, their form, the conditions under which they operate, and their relation to the rest of the grammar. The elaboration of such claims is the task of this chapter.

A basic assumption we will be making is that WFRs are rules of the lexicon, and as such operate totally within the lexicon. They are totally separate from the other rules of the grammar, though not from the other components of the grammar. A WFR may make reference to syntactic, semantic, and phonological properties of words, but not to syntactic, semantic, or phonological rules. Nor may a WFR refer to those properties of words which are directly associated with these rules, i.e. such properties as syntactic or phonological rule features. This is not a strange assumption. Though it is not controversial to allow a phonological rule to refer to the fact that a certain item is a verb, for example, one does not allow such a rule to refer to the fact that it is a verb that does not undergo the Passive rule. We will assume that a WFR, as well as not referring to other types of rules and related matters, cannot introduce rule-conditioned properties. This assumption is stronger than the last, and it will be discussed below. It is tied in with two earlier assumptions: that a WFR and its associated phonological operation are one and simultaneous; and that, as a consequence, words are entered in the lexicon in a fully concrete, specified form. A related assumption is that WFRs are different from other rules in the manner and occasion of their use. The syntactic and phonological rules are necessary and essential to the generation of every sentence. It is impossible to speak without using some analogue of the syntax and the phonology. However, this is not the case with the rules of the morphology. It is the dictionary entries themselves which are the input to the syntax and phonology, and the WFRs are merely rules for adding to and, derivatively, analyzing, these entries. Thus it is very easy to speak a sentence without having any recourse to these rules. They are not "on line". Though this fact does not necessarily mean that WFRs will differ from others in their formal properties, it does suggest that the two categories are quite separate.

For every WFR we must know two basic sorts of things. First, we must know what sort of information a WFR can have access to, and how it has access to this information. It is obvious that every WFR may have access to its base, i.e. the class of words on which it operates, and to the information contained in its base. It is also possible that a WFR can take into account information other than that contained in the base. It might have access to its own output, or to forms related to the base. However, access to anything other than the base calls

for rules of a much more powerful sort than we would prefer to have. We will therefore operate on the assumption that a WFR can be cognizant only of information contained in its own base.

The second sort of thing one must know about is the sorts of operations a WFR performs, the sorts of changes it can make, and the formal mechanism by which these changes can best be stated in a general way.

Perpendicular to this classification of phenomena there lies another. There are different kinds of information in a grammar: syntactic, semantic, phonological, and morphological. Words contain information of all these types, and WFRs, as rules for making up new words, most likely introduce all of these types of information as well. This chapter will be organized along this latter axis. First we will discuss the syntax and semantics of WFRs, then their morphology, and finally their phonology. Under each of these headings we will discuss first phenomena relating to the base, then phenomena relating to the output and operation of the rules. Finally, we will attempt to synthesize from all these data a description of the general properties of WFRs.[1]

4.1. Syntax and Semantics

4.1.1. The Base and the Unitary Base Hypothesis

The base is always specified syntactically. So, for example, the rule which attaches the suffix *#ness* (*redness, porousness*) operates only on adjectives. Finer syntactic distinctions than the merely categorial are possible, and matters of subcategorization are commonly referred to. Thus, the suffix *+ee* (cf. Siegel (1971)) attaches only to transitive verbs (*employee*, *payee*, **travelee*). WFRs may also be sensitive to the selectional restrictions of the base. So, this same suffix is further restricted to verbs which allow animate objects or indirect objects (**tearee*). More detailed, and a little more exotic, is the constraint on the base for the prefix *re#*, which forms words such as *repaint* and *rewire*[2] and which has been studied in some detail by Williams (1973). This prefix attaches only to verbs whose meanings entail a change of state, generally in the object of the verb. Compare the following sentences:

(1) John punched Bill.

(2) *John repunched Bill.

(3) John punched the holes in the paper.

(4) John repunched the holes in the paper.

[1] This chapter is of necessity at once more programmatic and more detailed than the others in this book. We know that there are WFRs in a grammar and we have some very general ideas about these objects. Now our task is to be specific. We must therefore look at many WFRs and examine their intricacies. This makes for detail. At the same time, since the framework is new, we are less certain than we might be of individual analyses and their import. The combination sometimes leads to a form of exposition disconcertingly characteristic of the field: the baroque maelstrom, wherein the import of a given argument seems to be directly correlated with its distance from the apparently major aspects of an analysis and wherein the answer is so far from the question as to destroy any link between the two. I have tried to avoid this Charybdis.

[2] We are discussing here the prefix *re#*, which is distinct from the prefix *re=* of *refer* and the prefix *re+* of *remind*. The distinction between # and + is more than phonological and is treated in some detail in chapter 6.

The grammaticality of (4) and the corresponding ungrammaticality of (2) can be accounted for by the above-mentioned constraint on the meaning of the base. The verb *punch* of (1) does not entail any change of state in its object. I may punch someone without my action having any effect on the person. There is no change of state; therefore, *re#* is not possible and we judge (2) to be ungrammatical. On the other hand, the verb *punch* of (3) does imply a change of state in its object. If I punch a hole in something, the object punched has been perceptibly changed; therefore, *re#* is possible with this verb, and (4) is a good sentence.

It appears to be a general fact that the syntactic and semantic conditions on the base of a WFR are those of category, subcategory, selection, and lexically governed entailment and presupposition. These are the same sorts of restriction that are relevant to lexical insertion. Note that there is, to my knowledge, no correspondence between the conditions on WFRs and those on transformations other than lexical insertion. For example, the base of a WFR never need contain a variable. This fact strengthens the assertion of Chomsky (1970) that WFRs are very different rules from syntactic transformations.

We will assume that the syntacticosemantic specification of the base, though it may be more or less complex, is always unique. A WFR will never operate on either this or that. The seeming counterexamples to this that I have found can be analyzed as separate rules whose operations happen to be homophonous. Consider the affix *#able*, which attaches to both nouns (*fashionable*, *sizable*) and verbs (*acceptable*, *doable*). The most concrete evidence that we are dealing here with two different affixes is the fact that the nominals of *N#able* and *V#able* are formed by different rules. The denominal adjectives always take the nominal ending *#ness* and never *+ity* (*fashionableness*, **fashionability*; *sizableness*, **sizability*), while the deverbal adjectives show no real preference (*acceptability*, *acceptableness*; *moveableness*, *movability*). We can account for this difference most easily if we regard the two sets as separate and formed by different rules. Slightly less palpable evidence comes from the fact that the two *#ables* have very distinct semantics. The deverbal one means approximately 'capable of being *X*ed (where *X* is the base)'. The nominal one means 'characterized by *X* (where *X* is the base)'. This difference shows up in cases in which a form *X#able* can be derived from homophonous noun/verb pairs. If we are dealing with two affixes, then it is in only these instances that the word *X#able* should be ambiguous between the two senses noted above. Though there are few cases, the evidence is favorable. *Fashionable*, which may be either deverbal or denominal, has the two senses 'in fashion' and 'capable of being fashioned'. Similarly, *sizable* means 'of great size' and 'capable of being sized'. Such a consistent correlation of homophony and ambiguity can only be accounted for on the hypothesis that we are dealing here with two different affixes, each with its own meaning and each with its own base.

The unitary base hypothesis is a strong assumption and easily refuted. One must merely show that a certain WFR operates on two distinct classes of bases.[3]

[3] The word *distinct* is important. It is not sufficient to demonstrate that a suffix attaches to both nouns and adjectives, for example. There are ways to formalize these two as constituting a single class within the extended standard theory of Chomsky (1972a). However, if a WFR applied either to adjectives or to transitive verbs (two classes which could not be subsumed under one without including others as well), then we would have a counterexample. Similarly, the rule investigated must be a reasonably productive one, for, as we have seen, less productive rules tend to be less coherent, and we should naturally expect more variation and exceptional behavior with such rules.

4.1.2. The Output

The most studied aspects of morphology, at least the aspects most studied within the framework of generative grammar, are the relation between the syntax and semantics of the base and that of the output of a WFR, the common properties which the two share, and the ways in which these relations and commonalities can be accounted for. The scope of these matters is large and, if only for reasons of space, I will not take up the subject in this monograph. We will simply assume the existence of some mechanism for representing the relations in question, satisfying ourselves solely with the syntax and semantics of the output itself.[4]

Neither will we take up the question of "possible meaning"; whether, independently of morphology, there are formal and other constraints on the meanings of words. Much of the work on lexical decomposition, though it may seem to be related to morphology, is really addressed to this question.[5]

Syntactically, every new word must be a member of some major lexical category, the exact category being determined by the WFR which produces the word: *#ness* produces nouns (*redness*) and *#able* adjectives (*definable*). The output can assume the form of a labeled bracketing in which the syntactic category of both the base and the output are specified and the base is represented by a variable. So, for example, the WFR which attaches *+ee* (discussed briefly above) forms nouns from verbs. This is represented as follows:

(5) $[+[X]_V +ee]_N$

[4] In the literature on the syntactic relationships between the base and output of what I call WFRs, one sort of fact is usually overlooked: though it is often noted that many features are mapped from the base onto the output of the rule, it is seldom mentioned that there are some which are lost. In many cases the loss is idiosyncratic, but sometimes it is systematic. Consider the following example.

The two verbs *break* and *show* allow specific prepositional phrases (PPs) to follow them:

(i) They broke the glass *into six pieces.*
(ii) We showed the film *to the children.*

To each of these verbs there corresponds an adjective of the form *X#able*: *breakable*, *showable*. These adjectives may not be followed by the corresponding PPs:

(iii) *The glass is breakable into six pieces.
(iv) *The film is showable to the children.

Without the PPs, the sentences are acceptable:

(v) The glass is breakable.
(vi) The film is showable.

One cannot explain this distribution on the grounds that adjectives do not allow such PPs to follow them, since specifically those adjectives of the form *Xable* which are not regularly derived from verbs do allow such PPs:

(vii) This object is visible to the naked eye.

Nor can we invoke semantics, since the passive construction, which some (e.g. Chapin (1967)) have claimed to be involved in the derivation of *X#able* forms and which roughly paraphrases the *X#able* form, also allows these PPs:

(viii) This glass can be broken into six pieces.
(xi) This film can be shown to children.

It would thus appear that an externally unmotivated feature of the WFR *X#able* forbids PPs which are subcategorized by the verb *X* to appear after the adjective *X#able*. What this means is that the simple view of a WFR as consisting of a purely additive function must be revised.

[5] Among the recent work in this area I can recommend Horn (1972). Of the traditional sources, Ullmann (1957) is the most comprehensive.

Semantically, the meaning of the output of a WFR will always be a function of the meaning of the base.[6] This function is the meaning of the WFR itself. Traditionally, the meaning of a WFR is represented by a paraphrase containing a variable. So, for example, the agentive occupational suffix *#er* can be roughly paraphrased as in (6):

(6) $V\#er_N$ 'one who Vs habitually, professionally, . . .'

This meaning is exemplified in words such as *baker*, *programmer*, and *diver*. Such paraphrases should not be taken to be theoretically significant. Hopefully, a well-developed theory of semantics will provide some better representation than mere paraphrase.

Paraphrase also misleads one into thinking that the peculiarities of a rule such as the one attaching *#er* are specific to it; that this is a rule of English and completely unrelated to any rule of any other language. This is not true. Many other completely unrelated languages have similar "one who Vs" nominals, and in these too modifiers such as "habitually, professionally" are also often valid. Modifiers such as these are also a puzzle for those who would wish to derive *V#er* from *V* by a simple syntactic-like operation. Words like *habitually* are not usually lost in the course of syntactic derivations, yet such must be the case if we wish to derive *baker* from *bake*. Traditional labels like "abstract nominal" are sometimes more helpful, and more able to account for the data, than paraphrases. Consider the two English affixes *+Ation* (as in *derivation*) and *#ness* (as in *porousness*). The first is a "deverbal abstract nominal" and has the meaning 'act of *X*ing, or act of being *X*ed'. The second is a "deadjectival abstract nominal" and has the meaning 'fact or state of being *X*, extent to which something is *X*, or quality of being *X*'. The sets of meanings as expressed in the paraphrase are mutually exclusive; there is no way for *X#ness* to mean 'act of *X*ing', nor can *Xation* have any of the meanings of *X#ness*. Intuitively, this is because the latter is deadjectival, and hence cannot denote an action, and the second is deverbal, and hence cannot denote a fact, quality, or degree. Intuitively, also, the paraphrases are not accidental. We know what a "deverbal abstract nominal" must mean, and what a "deadjectival abstract nominal" must mean. Yet a statement in terms of paraphrases makes it all accidental. We have no theory that tells us what the meaning of *X+Ation* and *X#ness* must and must not be.

As expected, the same sorts of information that a WFR is sensitive to are the sorts of information it can introduce. Even such things as lexical presuppositions can be introduced by WFRs. Looking again at the suffix *re#* studied by Williams (1973), we find that this suffix, as well as demanding of its base that its meaning involve a change of state, has a separate presupposition of its own. Consider the following sentences:

(7) John washed the dishes.

(8) John rewashed the dishes.

The second sentence presupposes that the dishes were washed by someone (not necessarily John), at some time previous to the time of the action of the verb of that sentence. The presup-

[6] This statement must be qualified by the further condition that the meaning of the output is determined by the base, but the strength of this prediction is determined by productivity, which is correlated with the morphology of the base (cf. below and chapter 3).

position is similar to the one entailed by the adverb *again*. It is separate, however, from the presupposition on the base. This is indicated by the fact that though I may hit someone again (in accord with the presupposition of the output), I may not rehit him (since *hit* does not meet the condition on the base, as noted in 4.1.1). Though no other WFR has been studied so carefully as this one with respect to its semantics, I suspect that others may be just as complex in their regularities.

4.2. Morphology

4.2.1. Morphological Restrictions on the Base

4.2.1.1. Abstract Morphological Features. It has long been recognized that the vocabulary of English is divided, for purposes of morphology (and to some extent phonology), into two distinct parts, *native* and *latinate*, and that there are many rules which are sensitive to this distinction. There are probably even further subdivisions, into *greek*, *romance*, etc.

A well-known phonological rule which is restricted to *latinate* items is the rule of Velar Softening (SPE, 219-223), which palatalizes *k* and *s* only in latinate forms. There are in addition many WFRs which are restricted to *latinate* bases. A good example is the suffix *+ity* (*oddity* is the only exception I know of to the restriction); it contrasts very nicely in this regard with its rival *#ness*, which does not discriminate at all between *latinate* and *native* words. WFRs restricted to native words are less common. One is the suffix *#hood*, of *motherhood* and *brotherhood*.

The most important thing to be noted about a feature like *latinate* is that it is abstract, much like an abstract syntactic feature. A question then arises as to what this abstract feature is a property of, words or morphemes? There is good evidence that the feature *latinate* is a property of morphemes. If such a feature were a property of individual words, then we would expect that different words containing the same morpheme would behave differently with respect to rules sensitive to the feature in question. This is not so. All words containing the morpheme *+ity*, for example, are *latinate*. This can be shown by the fact that all words of the form *Xicity* (*lubricity*, *felicity*) undergo Velar Softening, which, as noted, only applies in *latinate* forms.

Further evidence that it is the morpheme which is at least the basic carrier of the feature *latinate*, and also good indication of the abstract and arbitrary nature of the feature, is the fact that monomorphemic words tend to move into the *native* classification. For example, *#hood*, though restricted to *native* bases, attaches to words which are etymologically *latinate*, as in *priesthood*, *statehood*. But it is only monomorphemic words which are "exceptional". This makes sense if we are dealing with a feature which is both a property of morphemes and arbitrary. We expect monomorphemic words to lose this feature easily.

Stronger evidence comes from words which are made up of both *native* and *latinate* morphemes. Remember that the suffix *+ity* attaches only to *latinate* forms. Among the classes of words to which it attaches most productively is that of deverbal adjectives of the form

X#able (*advisable*, *digestible*). This class includes words like *doable*, *readable*, and *knowable*, which have native bases. *+ity* attaches to these words. *Readability* and *knowability* are well-attested. With regard to the feature *latinate*, these words have the structure [–latinate] [+latinate] [+latinate]. Since it is really the affix *#able* which is triggering the attachment of *+ity* and this affix is *latinate*, we can still preserve the statement that *+ity* attaches to *latinate* items only, in its simplest form, if we say that *latinate* is not a property of words but rather of morphemes.

Finally, and most convincingly, we can only account for the phonology of this last class of words if we assume that the feature *latinate* is a property of morphemes and not of words. As we have seen, a word like *forgiveable* has the structure [–latinate] [+latinate]. Remember that the phonological rule of Velar Softening applies only in [+latinate] items. If we assume that, when it is attached, an affix like *#able* causes the entire new word to be [+latinate] (by some sort of feature percolation), then the *g* of *forgiveable* would be in the proper environment for Velar Softening, since *forgive* is now [+latinate] and should undergo that rule. This does not happen. Nor does it ever happen that a phonological rule "overapplies" in this manner. A morpheme like *forgive* never becomes [+latinate] for the purpose of phonology. This general fact can only be accounted for if we assume that abstract morphological features are properties of morphemes and not properties of words.

Thus, one sort of morphological condition on the base of a WFR is a condition on abstract morphological features like *latinate*. From the above examples at least, it is possible to assume that a WFR will only be sensitive to the morphological features of that morpheme which is adjacent to the point of attachment of the morpheme of the WFR. A suffix would thus only be sensitive to the morphology of the last morpheme of the base, as in the last case, where *+ity* was only sensitive to properties of *#able*. Similarly, a prefix would be sensitive only to properties of the first morpheme of the base. We could then rule out the possibility of a suffix's being sensitive to the first morpheme of the base and a prefix's being sensitive to the last, and build up a theory which dictated the impossibility of these cases. A morpheme-based theory, for example, in which words are just strings of morphemes, could very easily incorporate such a restriction, and in a natural manner. Within the theory we are constructing, according to which words are formed from words and the base of every WFR is a word, it would not be so simple to incorporate such a general condition, for at the point of attachment of an affix the whole word and its morphology are present, not just the adjacent morpheme. As we shall see, this simple assumption is false. There are suffixes which are sensitive to initial morphemes. This fact is in a very roundabout way evidence for our general theory, for though we might think on a priori grounds that a system in which conditions could only be stated on adjacent morphemes and never on noncontiguous morphemes is simpler, within our theory it is difficult to see how it could be.

4.2.1.2. Restrictions Statable on Individual Morphemes. More tangible restrictions than [+latinate] are common. Most of these are of a positive nature and are correlated with productivity. Thus *+ity* attaches most productively to bases of the form *Xic*, *Xal*, *Xid*, and *Xable* (Marchand (1969, 314)).

I will give two examples of positive conditions that cannot be stated on adjacent morphemes. The first is simple. The deverbal nominal suffix *#ment* attaches most productively to verbs of the form *en+Y* and *be+X* (*encroachment*, *bewilderment*, *embezzlement*, *bedazzlement*) (cf. Marchand (1969, 332)). As noted above, this single example refutes the simple theory just proposed as to the nature of morphological restrictions.

The second example is a more complex one. It involves the negative prefix *un#*, which, as Siegel (1971) has demonstrated, attaches only to adjectives. (Specifically, she shows that nouns of the form *un#X* are derived from adjectives.) This prefix attaches most productively to deverbal adjectives, a class which includes present and past participles (*unflagging*, *unburied*) and words in deverbal *#able* (*unbearable*). The first two types are difficult to analyze, since they involve inflectional categories and perhaps drift as well. However, the class of adjectives in *#able* is clearly identified by its last morpheme, and *un#* is a prefix.[7]

There are also negative restrictions, cases where a certain WFR does not operate on bases of a certain morphological class. A simple example of such a restriction is one on *#ness*. As noted above, this suffix is not restricted from attaching to [+latinate] bases. However, it does not attach to adjectives of the form *X+ate*, *X+ant*, or *X-ent*: *decent*, **decentness*, *aberrant*, **aberrantness*, *profligate*, **profligateness*. There are exceptions, but they are not common: *accurateness*.

A more complex case of a negative restriction also involves internal constituent structure, but that matter is clearer here than in the above case of internal structure. The rule in question involves the denominal adjective suffix *-al* (*global, organizational, regional*). This does not attach to the class of nouns of the form X_V*ment* (i.e. the class of nouns of the form *Xment*,

[7] One question which arises in connection with these three classes is whether they are indeed three, or actually one: the class of directly deverbal adjectives. The case is not clear. There are restrictions on each of the three separate subclasses: verbs with particles are treated differently for each. With past participles, the particle is generally tacked on:

(i) uncalled-for, uncared-for

With present participles it is always dropped:

(ii) uncaring, unthinking

With *#able* the particle is sometimes retained and sometimes dropped:

(iii) unreliable, ungetatable

When the particle is retained, the derivative has a "jocular tinge", as noted in Marchand (1969, 202). Also, prefixed forms are treated differently in each case. If we are dealing with one class, then we must be able to account for the differences in an interesting manner while still preserving the utility of the notion *single class*. If we are dealing with three classes, then these differences need not be explained at all.

where X is an independently occurring verb). The restriction is exemplified in the list below:[8]

(9)	ornament	*orna$_V$	ornamental
	excrement	*excre$_V$	excremental
	regiment	*regi$_V$	regimental
	fragment	*frag$_V$	fragmental
	employment	employ	*employmental
	discernment	discern	*discernmental
	containment	contain	*containmental
	derangement	derange	*derangemental

The constraint in question depends on internal constituent structure and not merely on the existence of a related verb or on some possible derivation of *Xment* from a verb.

If we are constrained by sheer existence, then a problem arises with nouns of the form *Xment* from which verbs are derived (cf. chapter 6):

(10) He complimented me on my dress.

(11) Don't experiment with such things.

(12) Life is so regimented.

Since these verbs all correspond to nominals, and the derivation of *Xmental* is not blocked (*experimental, regimental*), the constraint cannot be stated merely in terms of existence, but rather must refer to internal constituent structure.

Nor, though it seems simpler, can we extend the argument to all *Xments* derived from (derivable from) verbs. Such words as *excrement*, *increment*, and *medicament* can be derived from the verbs *excrete*, *increase*, and *medicate* by a rule of obstruent deletion before *#ment* (obs → ϕ/ __ _#ment). But the result is a structure in which X is not strictly a verb, having lost

[8] There are two exceptions to our rule:

(i) government govern governmental
development develop developmental

In terms of sheer number, these are trivial. Walker (1936) lists about 500 words of the form *Xment*, of which the great majority are X_V*ment*. Also, the semantics of one of the derivatives, *governmental*, is curious: the noun *government* has at least two distinct senses. One is directly deverbal, the other extended:

(ii) His government of the country has been roundly criticized.
(iii) His government was defeated by a wide margin.

The sense of *government* in (ii) is that of a deverbal abstract action noun, and is similar to that of most deverbal abstract nouns in such diverse suffixes as *#ment*, *+Ation*, *#al* (*curtailment, finalization, denial*). The sense of the same word in (iii) is an extended substantivization, similar to that of *organization* in (iv):

(iv) The organization needs you.

The exceptional adjective *governmental* has only one sense, corresponding to the extended sense of *government*, that of (iii):

(v) The funds were used for purely governmental purposes.

The difference between the two senses of *government* can be represented in purely structural terms as being that between *Xment* and X_V*ment*; *governmental* is clearly derived from the former. If, therefore, we state the constraint on X_V*ment*, then *governmental* is no longer an exception. Whether the same can be said of *development* I do not know, as its exact meaning is not clear to me.

This structural solution would also cover cases such as *departmental* where, though *depart* is an independently occurring verb, *department* is not derived from it.

its final consonant. This distinction is of course very fine, and it depends on the assumption that obstruent deletion is a real rule. If it does hold, however, it shows that we are dealing not with some sort of global constraint of the form "*X* is derived from *Y*", but rather with one on the structure of the base *at the point* of the application of the WFR. The case, if real, is interesting, because it makes a distinction between a global and a structural element, and it obeys the more restricted structural statement.

We must conclude that there is a constraint against the application of the rule *-al* to bases with the structure X_V*ment*. This restriction cannot be explained away on general syntactic grounds. Normally *-al* attaches quite freely to other deverbal abstract nominals: *organizational*, *observational*, *reverential*, *preferential*.

There is a negative restriction, similar to the one above in involving internal constituent structure, on *+ity* derivatives of words of the class *Xous*, a class discussed in detail in chapter 3. There are no *+ity* derivatives of adjectives of the form *Xferous* (the largest class of *Xous* adjectives). Thus there are no nouns of the form *Xferosity* (**coniferosity*, **herbiferosity*) and no nouns of the form *Xferity* (**coniferity*, **herbiferity*).[9]

4 2.2. Encoding Morphological Restrictions. How do we go about encoding these conditions within a theory of word formation? The most obvious method is to simply list them as conditions on the bases of WFRs. Thus, we might state a negative condition such as the one on *+al* as follows:

(13) $X]_N$-al$]_A$
Condition: $X \neq [Y]_V$ment

Similarly for positive conditions, which, since they are correlated with productivity, will also assign some probability to the rule.

However, such direct statement is the limiting and least interesting case, and many seemingly independent conditions on WFRs can be attributed to other factors. Most negative conditions are the simple result of *blocking*, a phenomenon discussed in chapter 3. Blocking prevents the listing of synonyms in a single stem. An affix which is productive with a given morphological class will thus block the attachment of rival affixes to that class. At first glance, this blocking may look like an independent negative condition on the blocked affix. For example, we noted that *#ness* does not attach to bases of the form *Xate*, *Xant*, and *Xent*. This, however, is merely a result of the fact that the rival affix *+cy* does attach productively to these classes (and no others but *Xcrat*): *profligate/profligacy*, *decent/decency*, *aberrant/aberrancy*. The productivity of *+cy* thus blocks the application of *#ness* in these cases.

As we have noted, blocking is basically a constraint against listing synonyms in a given stem. In general, among rival rules only the rule which is most productive with a given class will be able to fill the slot for a given stem in that class. Of course, the productively formed item

[9] There may be semantic reasons for this, as none of the adjectives admit of degree modification, and it seems in general difficult to nominalize adjectives having this restriction. Thus, even *#ness* derivatives of *Xferous* are odd: *?coniferousness*, *?herbivorousness* Notable exceptions are *vociferousness* and *soporiferousness*. whose bases admit of degree.

may drift and in drifting leave its meaning slot, in which case another may take its place. The result is more than one item of a given class in a given stem, but not with the same meaning. Such is the case with *humanity* and *humanness*: the first has drifted. Similarly for *recital* and *recitation*.[10] Note that we are not excluding the possibility that two words will occur with the same meaning but rather that there should be two words with the same meaning and the same stem in the same person's lexicon at the same time. To exclude having two words with the same meaning is to exclude synonymy, and that is ill-advised. It is also quite possible for two different speakers to have two different words in the same stem with the same meaning and for one person to forget the word he has in a particular slot at a particular moment and to make up another one, for the moment. In fact, the blocking rule, stated as a condition on the filling of slots, predicts that the fewer the number of stably filled slots one has, the more likely one is to accept new words. This seems intuitively correct.

The blocking rule cannot account for all morphological restrictions. First, it can only account for negative ones, and it does not even account for all of these. The impossibility of the attachment of *-al* to X_V*ment* cannot be traced to blocking, simply because there is no other form to block it. Therefore, some of the negative morphological restrictions on WFRs, and all of the positive ones, must be stated independently.[11] I will review the one proposal which has been made in the published literature for a method of encoding these restrictions, that of Chapin (1967, 1970), and then go on to propose an alternative and, I hope, superior method of dealing with them.

4 2.2.1. Ordering of WFRs. It has been proposed by Chapin (1967, 1970) that WFRs must be ordered in a similar manner to syntactic rules. This is impossible within our theory, for the ordering of WFRs requires that speakers always carry out derivational processes for complex words, and the improbability of this forms the basis of the present work. It is therefore imperative that we demonstrate on independent grounds that the ordering hypothesis is untenable in spite of its initial appeal.

Ordering is a well-known device in syntax and phonology. Chapin (1967) notes that if we have reason to believe that WFRs are syntactic rules, and if we have reason to believe that there can be extrinsic orderings placed on syntactic rules, then we have reason to suspect that there

[10] No nominal suffix seems to be productive with the class *Xcite*: *citation, incitement, excitement/excitation*. This does not mean, however, that we will have more than one noun in a given slot, merely that within the class of verbs of this form the affix chosen will not be predictable.

[11] One negative condition which can be accounted for by something other than blocking is the following: it is impossible to form verbs from comparative adjectives of the form X_A*er*. The only verbs formed from comparatives are *better* (formed by a very productive ϕ rule), *worsen*, and *lower*. Note that the first two are formed on irregular comparatives. Now, on the assumption that only words in the lexicon can be used as bases for a WFR, and on the further assumption that only irregular words can be listed in the lexicon, it will follow that since most *#er* comparatives are perfectly regular they cannot be listed in the lexicon and hence cannot serve as bases for any verb-forming rules. The reason for the occurrence of *better* and *worsen* is thus merely the exceptional quality of their bases: they are irregular, hence listed, and hence candidates for bases. The sole remaining exception is thus *lower*, and it is peculiar in several ways. First, the adjective *low* has no associated verb, though most of the other common adjectives in its semantic class do: *deepen, heighten, widen, lengthen*. The reason for this is that the affix *+en*, which we will discuss below, does not attach to words ending in vowels (**grayen*). The existence of *lower* can perhaps be attributed to this complex of factors.

may be extrinsic ordering relationships among WFRs.

Prima facie, there are good reasons to believe that WFRs are not syntactic rules. The fact that words persist, and all the concomitant properties of words which this fact gives rise to, is one. A second reason involves the function of WFRs, compared with that of other rules.

What do syntactic transformations do? Given a deep structure, we apply to it the ordered set of transformational rules and arrive at a surface structure. If we decide, for one reason or another, to stop somewhere in the middle, applying the first half of the rules and forgetting about the rest, there is no guarantee (in fact it is highly unlikely) that we will produce a recognizable surface structure. This is because the entire set of transformations is really one huge rule or algorithm for converting a deep structure into an equivalent surface structure. The same is true of the ordered set of phonological rules.

However, such is not the case with WFRs. As their form implies, the application of any one WFR, which is always a rule for forming a word from a word, will give us a word. There are no intermediate abstract stages. Nor do these rules take us from one level of the grammar to the next as syntactic and phonological rules do. They do not turn an X of one level into an equivalent X of another level. Rather, they add something to an X, something at once phonological and semantic, and produce a Y which is an element of the *same* linguistic level as X and is not at all equivalent to or corresponding to X. It is thus quite clear that WFRs and transformations do not *do* the same thing. Therefore it is highly unlikely that WFRs will be ordered among syntactic transformations.

This does not mean that WFRs cannot be ordered. It merely means that there is no special reason for expecting them to be ordered among themselves. The type of ordering that has been proposed to exist among WFRs, it should be noted, is *arbitrary extrinsic* ordering. An extrinsic ordering is one that is imposed on two rules which, a priori, could appear in one order or another. The extrinsic ordering tells us that of two rules A and B, A applies first. There are nonarbitrary extrinsic orderings; such orderings are determined by external principles like the cycle in syntax, or the finer principles of Williams (1974). An arbitrary ordering is one which is not governed by any general principle, but must be stated specially for a particular pair of rules. This type of ordering is of course the least desirable, since it is the least constrained. As a matter of fact, all suggested arbitrary ordering hypotheses in the linguistic literature have been slightly stronger than this minimal one. Arbitrary extrinsic orderings are transitive; that is, if A precedes B, and B precedes C, then A precedes C.

Let us look at an example of how arbitrary extrinsic ordering can be used to account for morphological restrictions on the base of a WFR. Consider the following contrast. The suffix *#ism* attaches productively to words ending in *-al*:

(14) *constitutional#ism*
physical#ism
animal#ism

However, *-al* does not attach to words ending in *#ism*:

(15) **dogmat, ism al*
**fatal ism al*

This restriction cannot be attributed to the syntactic class of the words ending in *#ism*, since *-al* attaches to other abstract nouns: *inspiration*$_{N}$*al*$_{A}$. Nor is the concatenation *Xismal* generally prohibited:

(16) *strabism al, dismal, catechism al, embolism al, rheumatism al, baptism al*

These last items crucially differ from those in (15), however, in that the *Xism* form is not derived by any rule; there exists no corresponding free form *X*:[12]

(17) *strab, *dism, *catech, *embol, *rheuma, *bapt

Ordering of the relevant WFRs can handle all this material quite nicely. Rule B, the *#ism* rule, whose output is essentially $[[X]_{A}\#ism]_{N}$, is extrinsically ordered after rule A, the *-al* rule, whose output is $[[X]_{N}al]_{A}$. This ordering guarantees the impossibility of words of the form $[[[X]_{A}\#ism]_{N}al]_{A}$, i.e. the words of the type we wish to exclude. It permits us to generate words of the type (14), since to generate these rule A must apply before rule B, which our ordering permits. It also allows us to generate the words in (16) (*strabismal*) since the *#ism* in these cases, in a theory of word-based word formation, is not attached by a rule. We see, then, that the ordering handles a relatively complex set of data in a simple manner.

There is a mechanism which will produce the same result as ordering, at least when one is dealing with constraints on concatenation. One can simply state the negative concatenation conditions. So, one could put a negative condition on the base of rule A, which would say that A, *-al* Attachment, never applies to words of the form $[X\#ism]_{N}$. This will have exactly the same effect as ordering the rule which attaches *#ism* after that which attaches *-al*. There are several differences between the two theories, all of which weigh in favor of ordering, if we consider the power of the two. First, negative conditions on the base can refer to nearly any property a base could have, whereas ordering restrictions, in terms of what they can actually restrict, are much less powerful. Since conditions can encode all that ordering encodes, and then some, we must prefer ordering until it is shown that we must have recourse to the extra power the other device provides us with. The second way in which the two differ is with regard to multiple conditions on one rule. If it is perfectly transitive, the ordering theory makes certain very strong predictions, which the other theory is incapable of handling. If, in addition to the two rules above, which had the property that the output of B could not serve as the input to A, we have another rule C, whose output cannot be the input to B, within the ordering hypothesis, this situation forces us to order C after B. But this ordering, by transitivity, predicts that C cannot ever precede A, and predicts, completely independently of anything but ordering, that the output of C cannot be the input of A. Within the condition hypothesis, on the other hand, the fact that the output of C cannot serve as the input to B is an isolated fact, encoded as a negative constraint on B, with no predicted side effect on A. Within this theory, there is no reason why the output of C cannot be the input to A. The ordering theory thus makes a prediction where the other is silent. We must therefore prefer the ordering theory, and we must look at its predictions to see whether they are always correct.

[12] We will disregard the possibility and associated complication of *baptism* being derived from *baptize* and *catechism* from *catechize*.

With regard to the last issue, i.e. that of transitivity, Chapin adduces several examples which force the rejection of a complete transitive ordering. I will repeat one only. *+Ation* attaches to verbs in *#ize* (*standardization*), *#ize* attaches to adjectives in *-al* (*industrialize*). *-al* attaches to nouns in *+Ation* (*organizational*). Within the ordering theory we then have an ordering of the following sort:

(18) a. *+Ation* precedes *-al* (*organizational*)
b. *-al* precedes *#ize* (*industrialize*)
c. *#ize* precedes *+Ation* (*organization*)

If the ordering of WFRs is completely transitive and linear, then this is impossible, as *+Ation* both precedes and follows *-al*. Within an ordering hypothesis, we must have recourse to some sort of cyclic ordering here if our ordering claim is to have any force at all. As Chapin (1970) notes, because WFRs are all optional, the simple cycle of syntax is equivalent in their case to no ordering at all. If we place all WFRs in a cycle, then any WFR may follow any other WFR immediately, given enough cycles. This leads Chapin to propose what he terms an *epicycle*, whereby all WFRs are placed in a linear order by extrinsic conditions, and rules which apply cyclically, as in (18), must be adjacent to each other in the complete linear order. Thus *+Ation*, *-al*, and *#ize* will be immediately adjacent to each other, in the order given, and these three may be epicycled on. Possible epicycles will be marked off by some device. (See Chapin (1970) for a more detailed discussion of the epicycle.)

As Chapin stresses, the epicycle is a highly suspect construct. It does have the virtue of being refutable. A possible counterexample, which Chapin rejects on grounds which I have discussed in another context (cf. 4.2.1.2), is *governmental*, whose derivation violates an epicycle (cf. Chapin (1970, 62)).

A more likely counterexample is the class of words of the form *Xatorial* (*dedicatorial*, *investigatorial*). Chapin establishes the order *al–ize–ation*. He shows that within an epicyclic theory the order *ation–al–ize* is incorrect. We mentioned in chapter 2 that Martin (1972) had established that words of the form *Xory* are derived from words of the form *Xion*. This fact establishes an extension of the ordering to *al–ize–ation–ory*. However, the class of words *Xatorial* shows that *-al* must follow *ory*. This ordering is a violation of the epicycle. Words of the form *Xatorial* thus refute the ordering theory even in its weakened epicyclic form, and we are led back to the less desirable alternative of simply stating conditions.

With regard to the first issue (that is, what sorts of things can be conditions on WFRs), there is more substantial evidence that the ordering theory is incorrect. First of all, WFRs must refer to abstract features like *latinate*. As noted above, the *+ity* rule must refer to this feature since it only attaches to *latinate* words. However, since many of the words to which *+ity* can attach are not derived, it must be possible to state the specification for *latinate* bases independently of ordering, i.e. as a condition on the base of the *+ity* rule. Thus there is need for such conditions even within a theory involving ordering.

WFRs must also occasionally refer to the stress pattern of the base. Siegel (1974) discusses two such cases, both of which will be described in detail below. Stress is generated by

phonological rules, and, as Chapin makes clear, it is impossible for a theory of conditions on WFRs which attempts to incorporate all these conditions into ordering statements to deal with such phonological conditions. Since there is no reason to doubt the reality of the phonological conditions which Siegel discusses, and there is no way to encode them into any other sort of restrictions, we must admit that they are strong evidence against the ordering theory.

Another major problem which the ordering theory faces is that of coexisting forms. To see how this is a problem, we must first review Chapin's account of the distribution of the nominal affixes *#ment* and *+Ation*. Citing an unpublished work by Emonds (1966), Chapin states that the distribution of these affixes is by and large governed by phonological properties of the base: verbs with the prefixes *eN-* and *be-* take *#ment*; verbs ending in oral or nasal stops take *+Ation*; verbs ending in *v* or *z*, preceded by an optional liquid, nasal, or peripheral stop, preceded by a lax vowel, take *+Ation* (*starve*, *sense*, *fix*); verbs ending in a liquid preceded by a vowel take *+Ation* (*console*, *explore*). All others take *#ment*. We can account for these data by ordering *+Ation* before *#ment* and marking verbs in *eN-* and *be-* as exceptions to *+Ation*. There are of course many exceptions, which are noted, but "the generalizations are striking." In addition, all other nominal affix rules are ordered before these two (*-al*, *-ence*, etc.). This serves to eliminate the application of either of these rules to stems which have nominals occurring with the other affixes (*occur/occurrence/*occurment/*occuration*).

We will not consider the empirical validity of Emonds's constraints. Rather, we must ask exactly what ordering is being used to encode here. It seems quite clear that ordering, when used with rival affixes, is being used to encode the blocking constraint. The reason we do not find **occurment* or **occuration* is because we already have *occurrence*. The same is true at least of the fact that *+Ation* does not attach to stems beginning in *eN-* and *be-*. First and most important, using ordering to encode the blocking facts obscures the actual function of the blocking. It predicts that there will never be pairs of nominals in the same stem, which is false. It is perfectly possible to have more than one nominal in a given stem, as long as the nominals do not have the same meaning. This fact is exemplified in the list below:

(19)

ment/ation	
consolement	consolation
assignment	assignation
al/ment	
committal	commitment
ence/ment	
condolence	condolement
ϕ/ment	
advance	advancement
escape	escapement
abandon	abandonment
al/ation	
approval	approbation

recital	recitation
proposal	proposition
ure/ation	
striature	striation
juncture	junction

Another problem, of course, is the establishment of disjunctive environments. Even Emonds runs into this problem. Because words which begin in *eN-* and *be-* may otherwise meet the conditions for *+Ation* attachment, all the words which begin in these prefixes must be made exceptions to the *+Ation* rule by some sort of rule feature marking device. Though it is possible to preserve the ordering theory by having recourse to such a device, the fact that one must have such recourse merely serves to show that ordering is being overextended in these cases and should be reexamined. We must conclude that ordering should not be used as a device to encode blocking, first because it predicts blocking where there is none, and second because the ordering can be established only by an abuse of the notion "disjunction".

I have not mentioned the fact that ordering is a most unsatisfactory device for encoding positive conditions on the base of a WFR. The fact that *#ment* attaches to verbs which begin in *eN-* or *be-* can be noted only derivatively. If a WFR is not ordered before the rule whose output is a certain form, then certainly this rule can apply to the output of that rule; but there is no way for ordering to express the fact that there is a certain affinity between WFRs and certain bases, that is, that a WFR will be more productive with certain bases than with others. As long as *#ment* attachment is ordered after the *eN-* and *be-* prefix rules, it may operate on verbs having these prefixes, but there is no way to encode the fact that it *prefers* these.

For all of the above reasons, ordering cannot be used as a device for encoding restrictions on the morphology of the base of a WFR. I have dwelt on the question of ordering for three reasons. First, arbitrary transitive linear ordering is a relatively highly constrained device for dealing with certain morphological conditions on the base of WFRs, and as such deserves consideration. It is also the only device for dealing with such phenomena which has been proposed in the literature. Second, it has been proposed, though we may question the logic of the proposal, that since we know other sorts of rules (specifically syntactic rules) to be ordered, then if we discover WFRs to be ordered in the same manner we have some justification for believing that WFRs and syntactic rules are related. We have shown that ordering is not a good device for dealing with conditions on the base of WFRs. We therefore have no reason to suspect that WFRs are ordered among themselves. This is a very strong indication that WFRs are not in the same class as syntactic rules but form a separate, self-contained set of rules. This gives added weight to the proposal that word formation is accounted for by a component of the grammar which is distinct from all others. Last, ordering of WFRs is impossible within the general framework of this monograph.

4.2.2.2. Unordered WFRs. We must conclude from the above section that WFRs are not extrinsically ordered among themselves. The only possible ordering among WFRs will then be intrinsic, which means in effect that WFRs are unordered. Within such a system, the morpho-

logical conditions on the base of each WFR must simply be stated for each rule.

Most negative restrictions will be accounted for by the blocking rule and thus will never have to be stated independently. Therefore, the fact that *-al* does not attach to bases of the form $[X]\ \#ism]_N$, which we dwelt on at length above, need never be stated directly, because words of this form are usually subject to the rival rule of *-ic* (*modernism, modernistic*) (cf. chapter 6 for justification of this derivation).

Positive restrictions, which can never be encoded into an ordering framework, are different. They are closely correlated with productivity, and productivity is a variable matter. Rules cannot simply be classified as productive or not productive; rather, there are degrees of productivity. It is therefore interesting that we can associate this variable property of productivity with the morphological composition of the base of a WFR, for it is just this one property which is not unique: a WFR operates on bases of different morphological classes.

Apart from the few cases in which a WFR has no morphological conditions on its base,[13] the productivity of a WFR will always be associated with the individual morphological subclasses of the base, rather than the unitary syntactic base of the rule. Thus, the productivity of *+ity* will not be a function of the whole class of *latinate* adjectives, but rather of each of the morphological classes *Xile*, *Xous*, *X+able*, etc. It is these classes which comprise the morphological conditions on the base, conditions which must be stated independently for each WFR and separately from the syntactic, semantic, and phonological operations of the WFR itself.

Now, as we saw in chapter 3, semantic coherence varies with productivity. Since productivity is associated with morphological conditions, then semantic coherence must also be so associated. This removes semantic coherence and productivity from the main body of the WFR to the conditions on it. The semantics, syntax, and phonology of the main part of the WFR will be purely discrete. The form, meaning, and category of the output will be a compositional function of the base. This allows us to preserve such statements as "*#ness* forms deadjectival abstract nominals." A completely discrete relation between the base and the output will, however, be true only of the ideal and most productive cases. The less productive a rule is with a given morphological subclass of its base, the less coherent the semantics.

Note again the importance for such a system of the unitary syntactic base hypothesis (4.1.1). If we did not have a unitary syntactic base for every WFR, there would be no way to isolate any discrete operation. The unitary base hypothesis can be tested empirically, and independently of any other of the claims I am making. Our theory thus depends crucially on several different hypotheses, each of them independently falsifiable, yet whose consequences are completely interrelated.

Summing up so far, we can say that a WFR has at least two parts. First, there is a part which specifies the syntactic and semantic characteristics. There will be no disjunction in the specification of these characteristics, and no negation. The semantics of the output of the WFR

[13] Such a one is deverbal *#able*, which, though it has no morphological conditions on its base, is intuitively felt to be very productive (cf. Chapin (1967)). Note that not all WFRs without morphological conditions on them are necessarily productive. The rule of *+ous* (*bilious, contagious*), which has no morphological restrictions on it to my knowledge, is decidedly nonproductive.

is specified here as a compositional function of the base. Second, there is a series of positive conditions on the morphology of the base. These conditions are associated with productivity and semantic coherence (which are, in a sense, the same thing).

I will give a simple example, the rule of negative *un#*. I will assume for the moment that the phonological part of the change of the rule consists of the addition of the prefix and its boundary: *un#*.

(20) *Rule of negative un#*

a. $[X]_{Adj} \rightarrow [un\#[X]_{Adj}]_{Adj}$

semantics (roughly) un#X = not X

b. Forms of the base

1. $X_V$en (where *en* is the marker for past participle)
2. X_V #ing
3. X_V #able
4. X+y (worthy)
5. X+ly (seemly)
6. X#ful (mindful)
7. X-al (conditional)
8. X#like (warlike)

(Of course, each of these will have some index of productivity and coherence associated with it. The list is given roughly in order of productivity. Remember that the mere fact than an item is not in one of the listed classes does not preclude it from undergoing the rule, unless it is subject to a negative condition.)

4.3. Phonology

4.3.1. The Phonological Operation

I have said that a WFR specifies a base, as well as some operation on the base which results in a new word. This operation will usually have some phonological reflex, some morpheme which is added to the base. We will call this operation the *phonological operation* of the WFR.

The operation is generally quite simple, and consists of the addition of some affix to the base. The WFR specifies the phonological form of the affix and its place in relation to the base. The rule of *#ness*, for example, adds [ness] to the end of the base. We will assume that the affix and its position are constant for a given WFR. This means that *#ness*, at least when introduced by the rule of *#ness*, is always a suffix and always has the form *#ness*. Nor does this rule give any other form which it might add instead of *#ness*, in some particular environment. The affix is a phonological constant. We will also assume that the boundary associated with the affix is a constant. This means that if we find two affixes which are phonologically identical except for the boundaries associated with them, they cannot be introduced by the same WFR.

We assume that the phonological form is constant and completely specified. No archiforms or abstract segments are allowed, in accord with the theory of Kiparsky (1973). We will

see in chapter 5 that the phonological form of an affix, though it must be fully specified, may have different realizations in environments determined by the morphology of the base. These different forms, called *allomorphs*, are introduced by a later set of rules called rules of *allomorphy* (cf. 5.3). It is significant that these allomorphs are determined not by individual bases, but by the morphemes of the bases, and by morphemes in the most extreme sense of the term: semantically empty roots. This is parallel to the fact that productivity is determined by morphological features of the base. It is also susceptible to parallel treatment; it can be removed entirely from the main body of the rule. All morphologically determined variation thus lies outside the WFR itself. Furthermore, variation can be totally ascribed to morphological properties of the base.

4.3.1.1. Copying Rules. The general phenomenon of reduplicated or copied affixes controverts the simple statement that affixes have a phonologically constant form. Reduplication rules copy one part of the base of a rule and use this part as an affix or part of an affix. They are clearly morphological rules of word formation. First, there is no reduplication rule whose environment is totally phonological. (We are of course referring only to total copying rules, not to rules such as harmony rules which assimilate features of one segment onto another.) Second, reduplication rules are never ordered among the rules of the phonology. Both of these statements are easily falsifiable, but if they are true, they are sufficient to demonstrate that reduplication is not a phonological process. Reduplication rules are often said to have a "function" which is the same as that of WFRs. The notion is a little obscure, but we will take it to be correct and will assert that all copying rules (*not* assimilation rules) are WFRs. However, it is clear that if they are WFRs, then the affixes introduced by them cannot be called phonologically constant.

Consider for example the well-known Klamath vowel copy rule (Kisseberth (1972)). There are prefixes in Klamath which have fixed consonants, but whose vowels are copied from the initial vowel of the stem:

(21) a.

Noncausative	*Causative*
pe:wa 'bathes'	hespe:wa
no:ga 'is cooked'	hosno:ga
ma̤:s?a 'is sick'	hasma̤:s?a

b.

Noncausative	*Causative*
q̣e:gi 'is absent'	sneq̣e:gi 'loses something'
qdo.ča 'rains'	snoqdo:ča
tsa:ktgi 'become light (in weight)'	snatsa:ktgi

c.

Nonreflexive	*Reflexive*
ne̤:sla 'has sexual intercourse from behind'	sene̤:sla
lo:čwa 'covets'	solo:čwa
twa:q̣a 'smears'	satwa:q̣a

The three prefixes all have different vowels in each case, the vowel being the same as the first vowel of the stem. Kisseberth gives evidence that the vowel of the prefix, though it must be present in underlying phonological representation, cannot be shown to be represented in this underlying form by any one of the surface vowels of Klamath. He therefore has recourse to an abstract segment V*. The prefixes are listed in their underlying forms as *hV*+*, *snV*+*, and *sV*+*. A phonological vowel copy rule applies only to V*, and replaces it by the first vowel of the stem in all instances. Within the theory being put forth here, and the theory of Kiparsky (1973), V* is not a permissible underlying segment and the rule of vowel copy is an impermissible rule of absolute neutralization. However, it is only by using an abstract segment like V* that we can preserve the hypothesis that the morphological operation of a WFR produces a phonological constant. It seems to be impossible to preserve both hypotheses; either we give up the prohibition on abstract segments, or we give up the phonological constant. This dilemma will be forced upon us in all instances of copying rules.

However, the dilemma can be easily resolved. We have hypothesized that all copying rules are WFRs and that they are never ordered among the rules of the phonology. Kisseberth specifically notes that both of these are true of the Klamath vowel copy rule: both that it may be considered "morphological", and that "It is significant that no phonological rule must precede Vowel Copy, to my knowledge" (Kisseberth (1972, fn. 7)). This is fine, if we are only worried about the abstractness of phonological representations and are willing to allow abstract segments which are concretized by morphological rules prior to the phonology. But we are trying to make the even more restrictive claim that morphemes cannot be represented with abstract forms. The simplest way to retain this claim is to revise somewhat the view of a morpheme as a phonological constant. We will therefore view a morpheme not as a constant but as an operation.

Though morphemes are usually regarded as entities with independent status, just like stems, this is not the only possible way of looking at them. It is equally possible, and perhaps preferable, to regard a morpheme as a product of a phonological operation associated with a WFR. In the case of a phonologically constant affix, like *#ness*, there is no difference between the two treatments. However, when dealing with copying rules, if we wish to preserve the statement that no morphemes contain abstract segments at any level of derivation, we come to a quick decision between the two views of the morpheme. We simply replace the notion of a morpheme as a phonologically constant entity with one of a morpheme as the product of a unique phonological operation. This simple claim allows us to replace the Klamath causative prefix *hV*s* with the following rule:

(22) *Klamath Causative WFR*

$$V[C_0\ V\ X] \quad \rightarrow \quad {}_{V}[h\ 2\ s\ {}_{V}[1\ 2\ 3]]$$
$$1\ \ 2\ 3 \qquad\qquad\quad {}_{\text{Caus}\ -\text{lg}}$$

This rule will produce correctly all the forms of (21a). Similar rules will give us all the other forms of (21) and can be used for all other copying affixes. We no longer need worry about abstract morphemes since by stating the copying rule and the rule which spells out the mor-

pheme in the same rule we have avoided the intermediate point in the derivation at which the abstract segment occurs. This will always be possible if we are right in claiming that all copying rules can be ordered before phonological rules, for this claim implies that no rule will come between the rule which attaches the morpheme and the rule which spells out the copied segment(s) of the morpheme.

By accounting for copying by rules like (22), we are making three claims:

(a) Copying operations are parts of WFRs and are not phonological rules (the latter claim is already implicit in Kiparsky (1973)).

(b) WFRs are not labeled frames. (Rules like (22) cannot be represented by labeled frames.)

(c) Affixes, unlike stems, have no independent existence.

A possible objection to the encoding of copying operations into rules like (22) is that the use of such a device entails that if we have *n* affixes which contain copied material, we have *n* copying rules. If every affix contains a copied vowel, the "same" vowel, as in the case of the three Klamath rules discussed so far, then we must repeat the same operation for each affix, in this case three times. It seems intuitively incorrect to have to do this. The objection, it should be noted, is not one of substance, but rather one of manner: it is not that the incorporation of copying rules into WFRs prevents us from handling the data, but rather that it forces us to handle a certain array of data in an inelegant manner.

The theory which uses abstract segments, however, faces much more serious problems: there are types of copying rules which it is intrinsically incapable of describing. For example, in Klamath there is another reduplication prefix, which copies the first C_0V of the stem (the V is short as above). Note that this prefix copies not just the first consonant, but the entire first consonant cluster. This is exemplified in the following paradigm:

(23) *Nondistributive*	*Distributive*
pe:wa 'bathes'	pepe:wa
no:ga 'is cooked'	nono:ga
ntopa 'spoils'	ntontpa
qniya 'has an erection'	qniqnya

Since the number of consonants in the affix is equal to the number of consonants in the stem, and since this number varies with the stem, there is no way in which we can represent the consonants of this stem by abstract segments. This is so because sometimes the stem will contain one abstract segment, and sometimes two, and how many it contains is predicted by the stem. The vowel of course can be represented as V*. What Kisseberth does is to invoke a "morpheme of reduplication" which he calls R. R is realized by a rule as a copy of the initial consonant (cluster) of the stem plus V*. This rule is called Reduplication, and it is followed by Vowel Copy. This is a very awkward solution, for it uses a copying rule of the form of (22), as well as an abstract segment; in fact, the copying rule *introduces* the abstract segment. Abstract segments are bad enough; when such segments are introduced by rules, and exactly the sort of

rules which, as far as I can see, the abstract segments were designed to avoid, the system becomes very suspicious indeed. The above example demonstrates clearly the need for copying rules of the form and function of (22) in any system, and it shows that such copying rules are the source of abstract segments. This fact is bad for the theory which, by using abstract segments, allows us to state vowel copy as one rule, for it casts doubt on the validity of the abstract segments.

The general phenomenon of syllable copying is immensely troublesome for the abstract segment system. Consider the Hebrew *Pilpe:l* conjugation, which is formed by reduplicating monosyllabic roots:

(24)

Root	*Pilpe:l*
kul	kilke:l 'sustain'
gal	gilge:l 'roll'

We will not discuss the vowel pattern, which is characteristic of all active stems of the form CVCCVC. For the moment we can assume that the vowel of the root is copied and that a later rule adjusts the vowels. Within the system proposed, in which rules of the form (22) are permitted freely, and in which there are no abstract segments, the derivation of *Pilpe:l* forms is simple. If we use abstract segments, on the other hand, the matter becomes immensely complicated. If we represent the reduplicated part (we will assume the first syllable is the copy) by C*V*C*, then we do not know which stem consonant is copied onto which C* unless we have two copying rules: one for the first consonant, and one for the second:

(25) a. *Initial Consonant Copy*

$$C \rightarrow C_j / \#\_\_\_VC+C_jY\#$$

b. *Other Consonant Copy*

$$C \rightarrow C_j / X\_\_\_CVC_j\#$$

Assuming another rule for copying the vowel, we have a total of three copying rules for this one affix. Furthermore, they are rules that cannot be generalized to any other segments, for they will only apply to those *Pilpe:l* forms. None of these rules can even be extended to the one other conjugation which is formed by copying. This is the much more common *Piʕe:l* conjugation, which is formed by doubling the middle consonant of the triliteral root as follows:

(26)

root	*Qal*	*Piʕe:l*
gdl	ga:dal 'grow'	gidde:l 'raise'
šbr	ša:bar 'break'	šibbe:r 'smash'

If we disregard the problem of the infix, which will be treated below, the system allowing abstract segments requires the following rule for the reduplicated middle consonant.

(27) *Middle Consonant Copy*

$$C \rightarrow C_j / [_{root} CVC_j \_\_$$

The root marker is there to ensure that the rule does not apply in the *Hipʕil* form. One could alternatively restrict the rule to C*. In any case, whatever the exact formulation of this rule, it

is not the same as either of the rules of (25). We need three consonant copy rules for two affixes, none of which has any other justification, all of which apply to abstract segments only, and all of which can be ordered before any other rule of the phonology (there is no ordering among them).

All of these idiosyncrasies arise from the desire to state the Klamath copy rule once only, instead of three times. This desire leads us to posit four rules (including vowel copy in *Pilpe:l*) of no generality at all. This last example demonstrates perfectly the fallacy behind the rule counting argument. One theory gives us more rules in one case (Klamath) and the other theory gives us more rules in the other case (Hebrew).

Do we decide between theories idiosyncratically for each language, depending on the number of rules each theory needs? It seems wiser to disregard rule counting, and to ask what other sorts of things the two theories are saying. If we ask this question, it is clear that the theory which regards copying rules as a particularly complex sort of WFR is preferable. This theory predicts that copying rules will always apply at a certain point in the derivation of words, namely before the phonology, and hence that they will never follow any rule of the phonology; it rids us in a principled manner of a class of abstract segments which are problematic and undesirable on general grounds; it says that all copying rules are "functional", i.e. WFRs; and it gives us more clues as to the general form of WFRs. All of the claims of this theory can easily be falsified, and they are many. The other theory, which treats reduplicated segments as abstract phonological entities, makes no interesting and restrictive claims at all as far as I can see.

Note that I have not disproved the abstract segment theory. It is probably not very easily disproved, if at all. What I have done is to indicate that the advantage which this theory seems to enjoy over the one I am proposing is illusory at best, and not very interesting in the general case.[14]

Summing up this section on copying rules, I have claimed that all copying rules are WFRs, and that the phonological operation of a WFR, rather than spelling out a completely specified phonologically constant form, is in itself a unique phonological operation. If both of these claims are true, and we will assume them to be so, then we cannot state WFRs as simple labeled frames; rather, we must state them as transformations. This in turn helps us to differentiate formally between the affix and the stem, items which intuitively are very different. Another point of this section is the fact that if we treat copying rules in a certain way, i.e. as WFRs, then we can ban such rules from the phonology. This result is the first phonological conclusion of this monograph, and I think that, if correct, it is a very important one. What I have done so far is to elaborate a theory of derivational morphology on grounds which are completely independent of phonology (except, of course, that I have accepted a particular theory of the phonological component, well-motivated on phonological grounds, that of SPE, and on certain finer points, that of Kiparsky (1973)). Despite the fact that my theory of morphology is not built

[14] For those who like to anticipate, it should be noted that copying rules cannot be allomorphy rules, simply because they are completely independent of the morphology of their base. No matter what the morphology of the base, the copying rule is always the same. If we found different copies in different morphological types of stems, then we might want to use a rule of allomorphy.

on any phonological grounds, it has proven useful in solving a phonological puzzle of great particularity, that of abstract copied segments. It is the possibility of this sort of interaction which led me to investigate the entire area of morphology, in the hope that by discovering what was legitimately morphological we might be able to determine what legitimately belongs in other components of the grammar as well. We see here the first case of the (hopeful) success of this general method.

4.3.1.2. Infixing. We have asserted that copying rules are WFRs, mainly on the grounds of "functional" similarity. We have been able to assert further that WFRs cannot be written as simple labeled frames, because copying rules cannot be so written. However, because of the tenuous nature of the logic here, it would be better if we had independent grounds for the latter assertion. Such an independent reason is the impossibility of describing infixes in terms of labeled frames. Consider as a simple example the matter of the Hebrew *Pi'el* form, which is produced by reduplicating the second consonant of the root. The reduplication problem, which we have discussed, is independent of the question of where the copied consonant goes. As we see from the examples of (26), the copy goes next to the consonant it is copied from, and the rule has the effect of doubling the second consonant of the root. How can such a rule be stated? How do we specify the position of the copy? The copy goes *inside* the root, and therefore we must be able to factor the root, in order to know what inside position the copy takes. Such a factorization is impossible if we restrict the statement of WFRs to labeled frames.

For the sake of clarity, and in order to avoid the problem of copying that arises in this example, let us look at a very productive English infixing rule. The English infix *fuckin*, first studied to my knowledge by Siegel (1971) and which more or less has the function of expressing a certain attitude on the part of the speaker, occurs in words like the following (from Siegel):

(28) Mon$\overset{3}{\breve{o}}$nga–f$\overset{2}{\breve{u}}$ckin–h$\overset{1}{\grave{e}}$la
S$\overset{3}{\mathring{a}}$nta–f$\overset{2}{\breve{u}}$ckin–Cr$\overset{1}{\grave{u}}$z
f$\overset{3}{\hat{a}}$n–fu$\overset{2}{\breve{c}}$kin–t$\overset{1}{\acute{a}}$stic

The infix is restricted to stems which have a 3-1 stress pattern. Furthermore, it can occur only immediately before the 1 stress, as the following unacceptable forms show:

(29) *Mon$\overset{3}{\breve{o}}$ng–fuckin–ah$\overset{1}{\grave{e}}$la
*T$\overset{1}{\hat{u}}$r–fuckin–in
*Ch$\overset{0}{\bar{\imath}}$–fuckin–c$\overset{1}{\acute{a}}$go
*Ch$\overset{1}{\acute{\imath}}$cko–fuckin–p$\overset{3}{\bar{e}}$e

Siegel states the rule for infixing *fuckin* as follows (1971, 10):

(30) *Fuckin Rule*

$$[X\ \overset{3}{\breve{V}}\ C_0\ (\begin{bmatrix} V \\ -str \end{bmatrix} C_0)_0\ [\text{infix}]\ \overset{1}{\acute{V}}\ Y]$$

The trouble with using such a labeled frame to express the rule in question is that there is no place in the rule where the base is specified as an independently existing entity. The rule as stated has no way of expressing the notion "formed from". It is incapable of encoding this notion and that of "infix" in a single string, because the infix is inserted inside the base (this is after all the meaning of the term *infix*). In order to be able to express these two notions, we must be able to factor the base string and insert the infix between two of its factors, as shown below:

(31) *Fuckin Rule (revised)*

$$[X \overset{3}{V}\ Q \overset{1}{V}\ Y]$$

$$1\ \ 2\ \ 3\ \ 4\ \ 5 \rightarrow 1\ \underset{3}{2}\ 3\ \text{fuckin}\ 4\ \ 5$$

where Q contains no $\overset{3}{V}$

This statement of the rule allows us to express both the idea "formed from" and the infix. The form of the rule is the same as that of copying rules like (22). All infixing rules must have this form. The general phenomenon of infixation thus provides very strong evidence, independent of copying rules, for the impossibility of using labeled frames to express the phonological operations of all WFRs. This is assuming that the rule which places the infix in its proper position is a WFR and not a rule of the phonology, i.e. that it is not ordered among the rules of the phonology. This assumption will be discussed in a later section and is, as far as I can tell, essentially correct.

4.3.1.3. Consequences. We have found two classes of rules which are best viewed as WFRs, and which force us to state WFRs in a particular manner, namely as transformations. This is different from the system using labeled frames mainly in that it forces us to divide the rule into two parts, a structural description and a structural change. The first part specifies only the base. The second part contains the base and the result of the operation of the WFR, amalgamated into one unit. The formal nature of this bifurcation has an intuitive counterpart: the base is an independent entity, which we know already, for in order to qualify as a base it must be an independently occurring word and a member of a major lexical category: the affix (which in most cases is equivalent to the affixing operation) cannot be separated from the rule, because it is nowhere given any representation of its own. This intuitive counterpart is very different from the view which people normally have of affixes: namely, that they are independently existing entities; that they are morphemes, just like stems, and have all the properties stems have.

This view has led to many problems, of which I will mention only the two most commonly discussed. The first problem is that of discontinuous morphemes, like the Semitic vowel patterns. Though I cannot claim to have solved all the mysteries of Semitic morphology, it is clear that once we stop thinking of these vowel patterns as items of the same sort as the stems, we can stop worrying about the metaphysical import of these discontinuous patterns and begin to develop a framework within which they can be studied. Another problem which this view of WFRs relegates to the status of an artifact is that of the *zero morpheme*. In English, there are WFRs with which no morphophonological operation at all is associated. Though the

base undergoes semantic and syntactic changes, sometimes of a complex nature, nothing happens to its form. The most productive of these WFRs forms verbs from nouns. The semantics is very complex, and I do not know exactly how many rules are actually involved, but I have listed a few examples of different types below:

(32)

Noun	*Verb*
father	father
referee	referee
butter	butter
cement	cement
spear	spear
club	club
ship	ship
skate	skate
nail	nail
hammer	hammer
bale	bale

Within a theory in which WFRs are represented by labeled frames (or even simple concatenations, as the simplest theory supposes), how do we represent rules like the above? The answer is the zero morpheme. The rule taking *father* to *father* can be represented as follows:

(33) $[[\text{father}]_N \phi]_V$

We can then refer to this ϕ as the suffix for forming verbs from nouns. But the concept of a formless phonological substance like this is abhorrent, even ridiculous when we realize that for every WFR which has no associated phonological operation (and there are several in English (cf. Marchand (1969, 359-389))), we must posit a separate such entity, with a resulting proliferation of zeros, one for every rule: $0_1, 0_2, \ldots, 0_n$. Though the zero morpheme is not a necessary entity in a theory which uses labeled bracketings to represent WFRs (the theory of SPE uses labeled brackets and no zero morpheme), it is quite clear that in the theory being put forth here the zero morpheme has no place at all.

Last, we should note that the problem of a morpheme as a meaningful entity, discussed at length in chapter 2, though not resolved within the framework being put forth, can now be reduced to the problem of whether a WFR has meaning, since a morpheme is not independent from the WFR which introduces it. The problem of the meaning of a WFR has been approached by dividing a WFR into two parts: the central part, all of whose operations and elements are unique, compositional, and discrete (the base; the phonological operation; the semantic interpretation of the output as a function of the semantics of the base; the syntax of the output); and the morphological conditions on the base, which determine productivity and the semantic coherence of the individual output. Within such a framework, what should be constant about the "meaning" of an affix is the syntactic category it is a marker of, since the syntactic category of the output cannot vary with productivity. This constancy is true to a very great extent. Words drift, and monomorphemes, as noted in chapter 2, can drift just about anywhere, but

morphologically complex words do not drift out of their syntactic categories. Also, rules which have no phonological reflexes, like the rules involved in the derivation of the items in (32), generally do not apply to morphologically complex bases. There is a miniscule number of exceptions to this observation, among which are *proposition*$_V$, *referee*$_V$, *waitress*$_V$, *dirty*$_V$, and *muddy*$_V$. Marchand's explanation of this restriction is the fact that "suffixes are categorizers". The fact that suffixes are such strong markers of category is what we are predicting.

An interesting result of this last fact is that we can now have a somewhat finer view of the use of WFRs as rules of morphological analysis. When we encounter a word we have never heard before, one thing we can know pretty much for certain is the syntactic category of the word (if it is polymorphemic); and this is about all we can know for certain, since this is the only constant part of the WFR, the only part which is unaffected by the morphology of the base. Once we isolate the affix and the syntactic category of the putative base, we can look at the morphology of the base; if we know the meaning of the base, we can make guesses as to the "distance" of the newly encountered word from the base, on the basis of the coherence of the rule, which we know from the particular morphological category of the base. If the base is not a word, we know, as noted, nothing but the syntactic category of the new word. If the base is not a word, but is a member of a morphological category which is productive, we know more about the new word. If I have never heard the word *tangible* before, I know that it is an adjective, and that is all. On the other hand, if I hear the word *solemnization*, though I may not know the word *solemnize*, I know that the WFR of *ation* is very productive with bases of the form *Xize* and hence know that I am dealing here not merely with a noun, but with an abstract deverbal action. I think this conclusion is correct, though quite obviously it must be subjected to experimental verification.

4.3.2. The Place of the Phonological Operation in the Grammar

WFRs have been viewed as rules for adding new words to a dictionary and rules for analyzing existing words. They are once-only rules; a word is made up by applying a WFR, and the newly made up word is added to the dictionary. The phonological operation has been claimed to be simultaneous with the other parts of the rule, and to be separate from the rules of the phonology. No part of a WFR can be a phonological rule, orderable among the rules of the phonology. Rather the word is formed entire, as a completely phonological entity, prior to all the rules of the phonology.

But this cannot be true. Consider the *fuckin* rule discussed above. The infix must be inserted in a word which has a 3 - 1 stress contour, and it must immediately precede the 1 stress ($\overset{3}{K}$*alama fuckin*–*z*$\overset{1}{o}$*o*). In order to know exactly where to insert the infix *fuckin*, we must know the stress contour of the base. But the stress is determined by relatively regular phonological rules. Therefore, the infixation process must be ordered after some phonological rules. The only way in which we can enter *Kalamafuckinzoo* in the dictionary entire, and not with some abstract marker, like [fuckin infixation], is to give up the entire theory of phonology and enter the word in its surface form. This is something we do not want to do.

It appears that rules of infixation and copying are different from other WFRs, in that

their morphological operations (which, as we have seen, depend crucially on the actual base) can be ordered among the rules of the phonology. The question that we must now ask is how they are ordered among the phonological rules. If they are just phonological rules like any other, a possibility which we have repeatedly denied on external grounds, then they will have the same ordering properties in a phonological derivation; they will be subject to such phenomena as reordering. If, however, we can show that these rules will intervene in the phonology only at a specific number of places, then they are not phonological rules in the common sense.

To see how a rule could intervene in the phonology without being orderable as a rule of phonology, we must review the general conception of the structure of the phonological component as outlined in SPE. In that work, phonological rules are sharply bifurcated into cyclic and word-level rules. Exactly what sorts of rules are cyclic, and what sort are word-level, is a problem not discussed in SPE, and I have nothing to say on this matter. Cyclic rules apply first, cyclically, the limits of each application being determined by bracketings, which, we have argued, are determined by the morphology. Word-level rules are postcyclic or last cyclic, and apply only once. From this outline, we see that there are several points at which a rule might intervene in the phonology, without being ordered strictly between two phonological rules. The rule might apply before the cyclic rules, as we have argued most morphological operations do; it might be ordered between two cycles; it might be ordered after all cycles, but before word-level rules; or it might be ordered after all word-level rules, that is, after the phonology. If we allow a phonetic component to follow the phonology, then these latter rules could conceivably follow morphological operations.

I think that it is possible to restrict the application of the phonological operation of a WFR to three places in the phonology: first, before the phonology, as has always been assumed; second, before the word-level rules; third, after the phonology. Such a restriction on the place of these operations allows us to retain the position that WFRs do not interact with phonological rules, though they may interact with the phonology. It puts us on a middle ground, theoretically, between the most restrictive structuralist phonemic views on the ordering of morphologically and phonologically motivated rules (morphemic precedes morphophonemic precedes phonemic) and the unrestricting views of Anderson (1975), wherein there is no necessary connection between type and order.

4.3.2.1. Reduplication Paradoxes. I will now present a discussion of selected reduplication processes in a variety of languages and show that the phonological peculiarities of these processes can be easily accounted for if these processes operate at the places designated above, and at no other places. The widespread peculiarities of reduplicated forms cannot be dealt with in any other principled manner.

The data for the following section come from Wilbur (1973). Transcriptions vary with her sources. Wilbur begins from the observation that reduplicated forms are often exceptional, at least when viewed from the theoretical standpoint of standard generative phonology. Their exceptionality lies in the fact that the reduplicated affix (R_r), and the part of the stem of which it is a copy (R_o), are often identical in their surface phonological representations. If we assume

that reduplication is a morphological process which precedes all phonological processes, then this surface identity can sometimes only be attained at great cost, because the phonological rules, applying blindly, will produce different reflexes of R_o and R_r. The problem is to ensure that this will not happen, that R_o and R_r will be identical.

It is important to notice that this problem does not always arise. It is not always the case that the two are identical. The following derivation of an Akan[15] reduplicated form, from Wilbur, demonstrates how such a situation can arise:

(34)	/dumʔ/	+Redup ($C_1V_1C_2$)
	Reduplication	dum dumʔ
	Regressive Homorganic Nasal Assimilation	dun dumʔ
	Progressive Nasal Assimilation	dun numʔ
	Closed Syllable Vowel Nasalization	dũn nũmʔ
	Output	dũnnũmʔ

This situation is normal within a theory which assumes that all copying takes place prior to the phonology. The rules, which are independently motivated, apply in their proper order with no regard for extrinsic facts, i.e. that this is a reduplicated form; an incidental result of their application is that R_r and R_o are made dissimilar. This is the situation with which I am familiar. It holds in all the Semitic languages; in Greek, where the reduplicated initial consonant of the perfect prefix is subject to deaspiration; and, I am told, in Sanskrit. In all these familiar cases, if reduplication is prephonological, then everything goes through normally.

A simple example of an exceptional case is the following Madurese[16] form:

(35) kun 'order' kunkun 'orders'

The form is exceptional because an otherwise general rule of nasal assimilation which would give us the form **kungkun* has not applied. Nor is this an isolated form. Nasal assimilation does not apply to any reduplicated forms:

(36)			
	bangbang	'wings'	*bambang
	b–ar–ing–bing	'stand on end'	*barimbing
	d–al–ang–dang	'tall and thin'	*dalandang
	t–ar–əm–təm	'peaceful'	*tarəntəm

If the reduplication process precedes all the rules of phonology, then reduplicated forms must all be marked as exceptions to the phonological rule of nasal assimilation, for this rule fails to apply though its structural description is met. Wilbur presents several other examples of this sort of exception, where, within a conventional theory, we must say that a rule has failed to apply in a reduplicated form, with the result that R_o and R_r are identical.

All of these cases can be handled simply by ordering reduplication after the relevant phonological rule, in fact after all phonological rules. This device accounts for the nonoperation of the phonological rule and for the identity of the forms R_o and R_r. It is also possible to

[15] The Akan data and rules are from Schachter and Fromkin (1968).

[16] The Madurese data are from Stevens (1968).

achieve the same result by the proper manipulation of boundaries. Boundaries, however, will not suffice for the next class of phenomena.

A more curious type of exception, curious, that is, within the conventional framework, is one in which a rule seems to overapply; that is, it applies to a segment whose environment does not meet its structural description. In the following Chumash data, a rule of aspiration is involved which combines a voiceless consonant with a following *h* or identical consonant, to produce an aspirate.

(37) /k+kuti/ +Redup 'to look'

k+kut kuti	Reduplication
k^hutkuti	Aspiration
/ma+k+hawa?/ +Redup 'aunt'	
ma+k+hawhawa?	Reduplication
mak^{h}awhawa?	Aspiration

We see that in these cases reduplication and infixation precede the phonological rule of Aspiration, which then makes R_o and R_r dissimilar. In the light of the examples in (37), consider those in (38):

(38)

Base	/s–soyin/	/ma–k–hatinet/
Redup ($C_1V_1C_2$)	s–soy soyin	ma–k–hat hatinet
Expected	*s^{h}oysoyin	*mak^{h}athatinet
Actual	s^{h}oys^{h}oyin	mak^{h}atk^{h}atinet
Gloss	'it is very black'	'my joints'

The forms of (38) can be derived simply by ordering reduplication in these cases after Aspiration, in fact after all phonological rules.[17] The difference between the forms of (37) and those of (38) is due to the relation between the reduplication rule and the phonology in the two cases. In (37) reduplication precedes the phonology, in (38) it follows. Note that there is no question of Reduplication's being ordered among the phonological rules themselves. This is impossible, because the rule of Reduplication is not a phonological rule. I think the difference between the two sets of data gives striking confirmation to our theory, for it is just these two sets, and only these two sets, which our theory permits, and it is only these two which actually occur. Thus, by making one simple addition to the theory of morphology, we can account for all and only the observed irregularities of reduplicated forms.

There are other ways to account for the forms of (38). One could reduplicate the prefix as well as the first consonant of the root in these cases:

(39) s–soy–s–soyin ma–k–hat–k–hatinet

Aspiration would then apply to produce the correct forms. But in this solution we have two very different reduplication processes, one of which produces the forms of (37) and the other

[17] A mechanism is required which permits reduplication of a surface segment s^h which is the reflex of two underlying segments *s+h*, only one of which is part of the root proper. Syllabic structure seems to be at work here, a matter which is not easily incorporated into the theory of phonology we are using. We will assume a convention which matches syllable boundaries with root boundaries on the surface. This means that a root begins with a consonant on the surface, if it can.

the forms of (38), whereas in the ordering solution the rule is the same and only its place is different. Since the utility of ordering has already been shown, and since the solution of changing the form of the rules does not have as general an application, we must suspect the latter in the same way we suspect a solution involving boundaries in cases like (36). Boundaries can handle cases like (36), and a change in the rule can handle cases like (38), but the ordering theory can handle both, and in a principled and highly restricted manner that cannot be claimed for the other solutions.

Munro and Benson (1973) discuss a complex set of data in Luiseño. Here reduplication interacts with a number of phonological rules, and the type of ordering which we have proposed provides a satisfactory analysis. I will only give a rough outline of the phenomenon, and the reader is encouraged to look at the original presentation.

Three rules are of import here. First, a rule of syncope deletes a vowel preceded by a short stressed vowel and a single consonant and followed by a single consonant and a single vowel:

(40) čáq^{w}i- 'to seize' čáq^{w}la- 'to wrestle'

The second rule raises unstressed mid vowels to high vowels:

(41) hédi- 'to open' hidíki- 'to uncover'

The third rule, which we will call SH, changes č to š before a noncontinuant or #:

(42) té:ŋališ 'medicine' té:ŋaličum 'medicines'
qé:ŋiš 'squirrel' qé:ŋičum 'squirrels'

SH applies to the output of syncope:

(43) ʔé:či 'above' ʔéškawis 'upper lip'
móči- 'to weave' móšlat 'belt'

Stress is governed by a complex set of rules, and it in turn governs certain vowel deletion and shortening rules that are discussed in the sources.

What is important for our purposes is the interaction of the above three rules with reduplication processes. Normally, Reduplication applies to underlying forms:

(44) *Sample Derivations*

	/čapomkat/	/čik^{w}i:-/
Redup C_1V_1	čačapomkat+um	
Redup $C_1V_1C_2$		čik^{w}čik^{w}i:-
Various rules	čačapomkat+un	čik^{w}ičik^{w}i:-
Syncope	čačpomkat+um	čik^{w}ičk^{w}i:-
SH	čašpomkat+um 'liars'	čik^{w}išk^{w}i:- 'to suffer'

There is a class of reduplicated forms, produced by what is termed Adjective Reduplication, which always have the surface form $C_1V_1C_2V_2$--$C_1C_2V_2-š$:

(45) ʔáva- 'to be red' ʔaváʔvaš 'pink'
máha- 'to stop' mahámhaš 'slow'
ṣá:wa 'to wheeze' ṣawáṣwaš 'hoarse'

This is the only reduplicated form which is deintensificative; it means 'a little' and not 'a lot'. These forms can be generated in the usual manner, with one exception. When the first consonant of the C_1C_2 sequence is a *č*, it does not undergo the SH rule as expected. Instead of **čarášraš*, which is the expected form, we find *čaráčraš* 'torn'. Similarly, we find *čukáčkaš* 'limping' and not **čukáškaš*. Note that if we do reduplication postphonologically we rid ourselves of the exception. We will write the rule as an infixing reduplication rule:

(46) *Adjective Reduplication Rule*

C V C V X#
1 2 3 4 5 → 1 2 3 4 1 3 4 5

The change in stress can be accounted for by including the infix $C_1C_2V_2$ in a class which is motivated independently and which attracts stress to the syllable immediately preceding it.

However, there are two problems which face this simple rule (46). First, by reduplicating $C_1C_2V_2$, instead of $C_1V_1C_2V_2$, a step which is necessary if we are to account for the fact that SH does not apply to these forms, we lose the possibility of accounting for the absence of V_1 by the perfectly well motivated and otherwise general rule of syncope. For, if we allow syncope to apply here, then how can we refuse to permit SH, which follows syncope (cf. (43)), unless we adopt the kind of exception marker we have been trying to avoid? There is no way to account for both facts in a principled manner within the ordering theory: the fact that SH has not applied, which is patent, and the fact that syncope could have applied. The second problem is the application of raising of *o* to *u* in *čukáčkaš*, from the stem *čoka-* 'to limp'. Since stress is not determined until after reduplication, it must be presumed that raising has taken place after reduplication, which is a problem if reduplication is postphonological.

The first problem I have no solution for. It is true that the vowel in question could have been deleted by syncope; it is equally true that our theory denies this and replaces what could have been analyzed as one process by two separate and unrelated ones. Note that there is no evidence that syncope must have applied. This brings us back to the problem of real generalization which we dwelt on without any conclusion when we first encountered reduplication rules. I have nothing further to say on that point.

The second problem is less trying. Raising is a late phonetic rule. Reduplication will apply before such rules, and hence raising will apply to its output. We can conclude that the Luiseño data, though they can be accommodated in our theory, cannot be completely explained by it. Whether this is a problem must remain unknown until we have a better idea of what we are trying to explain.

There is a conceivable type of "exception" which cannot be handled by ordering of any sort, and hence is beyond the power of our restricted ordering theory. Wilbur describes what such an exception would be: if a rule of the phonology, whose structural description is not met until after a reduplication rule has applied, and which applies to R_r (the reduplicated part), also applies to the corresponding segment of R_o, even though this segment is not in the proper environment for the application of the rule.

She gives a hypothetical example. Let us presume that a language has an intervocalic

voicing rule. In this language, a form *inuk* could be reduplicated and then undergo the voicing rule, giving *inuginuk*, or it could be reduplicated after the voicing rule had a chance to apply and have the surface form *inukinuk*. Within any sort of ordering theory, there is no way to derive the third possible form, *inuginug*, in which the rule of voicing applies both to intervocalic *k* and to the final one, which is its "mate" in a certain sense of the term. Wilbur discusses at some length the sort of theory that could accommodate such a fact, and needless to say, it is much more powerful than the one I am proposing. Since the ordering theory, any ordering theory, cannot account for such an example, and Wilbur's can, we are left with an empirical issue and a question: Do such forms as the one exemplified by our hypothetical case ever appear in natural languages? If they do, then any ordering theory is incapable of dealing with natural language and must be abandoned. What we must do is go out and hunt for real cases.

Wilbur cites two "possible examples", both of which are isolated words. One is noted by her source as the only case of its kind in the language, and Wilbur quite correctly hesitates to say that it is crucial. The other example may be the result of a typographical error, for the author's discussion of the word in question seems to imply that it has another form (cf. Hill (1969, 362)).

The fact that Wilbur has been able to find only these two words, one of which is a unique exception in the language and the other of which may be spurious, seems to me to provide very strong evidence in favor of an ordering theory. Such a theory precludes words of this sort from being derived by regular morphological and phonological rules in a principled manner. Isolated forms whose derivation is uncertain cannot be considered as decisive evidence, except insofar as they are isolated.

4.3.2.2. Deletions. "Morphological" deletion rules are not common. Nor are they popular. In fact, such classic examples as Bloomfield's (1933) analysis of French adjectives have been reworked in such a way as to avoid the necessity of positing a deletion morpheme (cf. Schane (1968)). This unpopularity is understandable: within a framework in which a morpheme must have a constant phonological shape, deletion is even less substantial than ϕ; and, unlike reduplication, it does not lend itself to the straitjacket of abstract segments. Within our own framework, however, there is nothing abhorrent about a deletion rule, so long as it can be stated as a unitary phonological operation (as indeed the French rule can be). Now, if we allow reduplication rules to operate postcyclically, we should expect the same of deletion. In the case of deletion, the necessity of such an ordering will be transparent; the deleted entity conditions a phonological rule prior to its demise. Several examples of this type are discussed in Anderson (1975).

The clearest case is that of the Danish imperative, which is formed by deleting a final *ə* from the infinitive (if the infinitive ends in *ə*). Orthographically, the imperative is thus rendered identical to the stem. Phonetically, however, such is not always the case: the imperative often has a long vowel or consonant, or a *stød* (transcribed by ʔ), where the stem does not:

(47)	[bað] 'bath'	[spel] 'game'
	[bæːðə] 'to bathe'	[spellə] 'to play'
	[bæʔð] 'bathe!'	[spelʔ] 'play!'

Anderson notes that there is a general phonological rule in Danish whereby a short vowel (or, in certain circumstances, the following consonant) is lengthened before a single consonant *followed by a vocalic ending*. Lengthening then determines the insertion of *stϕd*. Lengthening and *stϕd* insertion also take place in the imperative, where there is no vocalic ending. The simplest solution to this problem is to order the imperative rule (deletion of *ə* from the infinitive) after the phonological rules of lengthening and *stϕd* insertion. Within our framework, imperative formation is a WFR with a postcyclic or postphonological operation.

I will merely outline an analogous case in Abkhaz which Anderson presents. Here an agreement marking verbal prefix *y* is lost if immediately preceded by the NP with which it agrees. This rule (which is clearly syntactic) interacts with a very regular phonological rule of epenthesis which has the following basic form:

(48) $\phi \rightarrow ə \,/\, C\_\_CC \left\{ \begin{matrix} V \\ \# \end{matrix} \right\}$

Examples: [yərtot'] 'they give it to him'
[yrərtot'] 'they give it to them'

y-loss, restricted to this one morpheme, and not applicable to other prefixes of the shape [y], must follow (48). This is evidenced by the fact that [yərtot'], in the proper environment, appears as [értot'] and not *[rtot']. Again a morphological (in this case syntactically so) rule follows the phonology. Note that in neither of the above examples is it the case that the morphological operation falls between two phonological rules. This is remarkable and in accordance with our theory.

4.3.2.3. Boundaries and Phonological Conditions. Siegel (1974) provides extensive evidence for the position that morphological operations apply at the level of the word as well as prephonologically. Siegel's theory divides English affixes into two classes: Class I, which is prephonological, and Class II, which is word-level. Evidence for her proposal comes from two sources: boundaries and phonological conditions on the base.

Boundaries first. Siegel associates the morpheme boundary + with Class I affixes and the word boundary # with Class II affixes. That Class II affixes should be attached after the application of cyclic phonological rules is almost self-evident: the sole purpose of this boundary in SPE (and its equivalent in Bloch and Trager (1942)) is to prevent the application of certain phonological rules, most notably stress rules (word-boundary affixes do not cause stress shift and are never stressed). The ordering which Siegel proposes immediately accounts for all the peculiarities of word-boundary affixes. Boundaries encode the place in the phonological derivation of the base at which the operation of a particular WFR takes place: + is prephonological, # is postcyclic (word-level), and we may assume that ## is postphonological.

The evidence from phonological conditions is more interesting. Traditional sources have remarked that WFRs are sensitive to phonological properties of their bases. As Siegel (1971) notes, the deadjectival verb-forming suffix *-en* is found attached to words which end in dental consonants, by and large. In fact, Marchand (1969, 272) notes that in the last 200 years only adjectives ending in *t* and *d* have served as bases for this rule. Exceptions to the rule date from an earlier, more liberal, period (*toughen, freshen, weaken*). The point of the example

is to demonstrate that there are phonological conditions on the base of a WFR. Now, phonological representations differ from morphological representations in that a given morphological word has many phonological representations associated with it. There is the underlying representation, the surface, and all points in between. Whether WFRs can have access to any one of these levels is an empirical issue. What Siegel sets out to show is that the level at which the phonological conditions on the base of a given WFR are stated is the level at which the affix is attached, and only that level. This is a highly restricted and symmetrical system.

Now, since Class II affixes are postcyclic, they have access to information introduced by cyclic rules, most obviously stress rules. If Siegel is correct, we should expect to find stress-sensitive Class II (# boundary, unstressable) affixes, and no stress-sensitive Class I (+ boundary, stressable) affixes. This is the case.

The best-known example of a stress-sensitive affix is the nominal suffix *#al*. Ross (1972) noted that this suffix occurs only after a stressed vowel. The exact position for its attachment, as formulated by Siegel (1974), is after a stressed vowel followed by an optional sonorant followed by an optional anterior consonant:

(49) trial, denial, refusal, rehearsal, arrival, *constructal, *organizal, *resistal

The only exception to this rule is *burial*. That *#al* is a Class II suffix is clear from its not having any effect on the stress pattern of its base.

A similar example is *#ful*, which we have already discussed briefly in another context, and which is discussed at length by Siegel (1974), after Brown (1958).

We noted in passing that the infix *fuckin* was sensitive to the stress of its base. It is obvious that this phonological condition cannot be stated until the stress of the base is determined. In this case, however, it seems that we are dealing with a postphonological ## boundary infix. Both the base and *fuckin* have the stress contours that they would normally have in isolation, and the infixing affects neither one, at least in terms of their segmental phonology and the relative stress levels in the base and in *fuckin* considered separately. The 1-stress of *fuckin*, however, is subordinated to the 1-stress of the base, as shown below:

(50) K$\overset{3}{\text{a}}$l$\overset{1}{\text{a}}$mazoo f$\overset{1}{\text{u}}$ckin K$\overset{3}{\text{a}}$l$\overset{2}{\text{a}}$maf$\overset{1}{\text{u}}$ckinzoo

The ## boundary will automatically account for the subordination, since the Nuclear Stress Rule will apply as it does in compounds like *Madison Avenue*, giving the correct stress contour.

All of these affixes show a striking correlation among three things: the point at which the phonological condition on a WFR is stated, which is at least postcyclic, the point at which the operation of the WFR is performed, and the boundary associated with the affix.

4.3.2.4. Implications. We have seen the ramifications of a theory in which morphological operations can take place at certain very specific places in a phonological derivation. There is no question of these operations ever interacting with individual phonological rules.[18] We first

[18] A book might be more appropriate than a footnote here. There is a wealth of data from Tagalog and related languages bearing directly on the question of the ordering of reduplication and infixation rules with respect to phonological rules. Work has already been done by Carrier (1975) and Cena (1975) on these problems (within the general framework of this book). The fantastic complexity of the morphology of these languages, however, demands that deep and thorough study precede any statement from which important conclusions might be drawn.

showed that reduplication rules may operate at breaks in the phonology. The same was demonstrated for deletion rules and infixation rules. We then saw that this odd ordering is not due to the nature of these rules, which, unlike the more familiar varieties, must have access to the internal workings of stem and base in order to spell out the exact form and place of the affix they attach; rather, the same orderings apply for rules with constant affixes. The only difference is that because of the nonconstant nature of reduplicated and other base-dependent affixes it is easier to discern their interaction with the phonology than in simpler cases, where we must have recourse to evidence of a much more roundabout nature.

Our theory accounts for the peculiarities of the different morphological boundaries; boundaries encode the place in the phonological derivation of the base of a WFR at which the operation of the WFR is performed. Phonological conditions are also correlated with the operation: if an operation takes place at a certain point, then the phonological condition must be stated at that same point. There will therefore be as many different boundaries, and types of phonological conditions, as there are levels at which the operations of WFRs may take place.

There is still an important difference, however, between reduplication and other base-dependent rules and rules with constant affixes. In the case of the latter, boundaries serve a sort of global function: they encode the place of the phonological operation. We never need to repeat the operation, once we have formed the word, because the boundary will make sure that the affix is not processed by the phonology until the correct point in the derivation. With base-dependent rules, however, though the boundary must still be inserted (as we saw in the case of *fuckin*), the character of the role makes it impossible to use the boundary as a global marker. In cases where such rules apply at points other than the input to the phonology, there is no way to list the output of the operation in a lexicon without drastically altering our view of the nature of phonological representation and the role of phonological rules in a grammar. The WFR must carry an abstract marker like [+*redup*] attached to the base. At the appropriate place in the phonological derivation of the word, this marker triggers reduplication, infixation, or deletion. Such cases obviously contradict the general statement that WFRs are once-only rules, for word level reduplication and infixation cannot be so defined. I have not explored the further implications of this fact.[19]

4.3.3. Boundaries and Cycles

We are now in a position to correct somewhat the theory of the cycle first put forth in chapter 2. The basic claim made there was that the phonological cycle is determined by the morphology: there is a cycle for every affix which is the result of a well-formed WFR (which contains a word). This is not true. # boundary affixes block the application of cyclic rules. We have seen why this should be the case: such affixes are added at a point in the phonological derivation after the application of all cyclic rules. It follows from this that no cyclic rule will ever apply to them, that is, that they will block the cycle.

[19] We have already seen that the output of the most productive of WFRs must not be listed in the lexicon. These most productive rules are therefore not once-only rules either. We will see later (in chapter 6) that the type of phonological boundary usually associated with productive WFRs corresponds to the word-level and postphonological reduplication rules under discussion here. Hence, it is possible that there is an intrinsic connection between listing and phonology.

The following are then the basic claims of our theory insofar as it affects boundaries and cycles:

(A) There are as many types of boundaries as there are points in a phonological derivation at which WFRs may operate.
(B) The boundary is determined by the point of the operation.
(C) The phonological cycle is determined by + boundary WFRs: there is a cycle for every such WFR.
(D) There are no global phonological conditions on WFRs.

I do not think there is anything startling in the above theory. It tells us about the interaction of the morphology and the phonology. The morphology does not completely determine the phonology, as one might naively think, for every WFR must carry a boundary, and the cycle is limited to one type of boundary. Now we see the point of the assertion that every WFR has a constant boundary associated with it.

4.3.4. Problems

4.3.4.1. A Condition on the Surface Form of the Output. Aside from its other peculiarities, the deverbal affix *#ment* attaches productively to bases ending in the palatal stridents *š*, *ts̆*, *dž* (*abridgement*, *estrangement*, *impeachment*). This fact is correlated with the lack of productivity of the rival suffix *+Ation* with the same phonologically determined class. There is a curious reason for the nonproductivity of *+Ation* in these exact cases. The reason is that a rule of English phonotactics rules out the occurrence of two coronal fricatives in adjacent syllables. It is not only words in *+Ation* which obey this rule; the rule of *#ish* gives evidence for it as well:

(51) sheepish, piggish, *fishish, *drudgish

We are therefore dealing with a phonological surface condition which is completely independent of any one WFR. We can clearly see that the condition has reference to no other level from forms like *admonition*, as we shall see in chapter 5, this word is derived by the *+Ation* rule and not by a separate *ion* rule from *admonish* (which ends in the forbidden palatal strident), and it is permitted because it does not violate the condition *on the surface*.

Note that there is no question of globality. There is no constraint on *+Ation*, but rather a completely independent one which just happens to affect some otherwise possible *+Ation* forms. This is important: we have insisted that there are no global phonological constraints on WFRs and that all seemingly global phenomena must be traceable to other sources. This one is.

Returning to *#ment*, we can trace its productivity with bases in coronal fricatives to the completely external phonotactic rule. Because the *+Ation* forms are forbidden, no blocking applies here. The nominal slots of the verbs in question are open, and *#ment* fills them.

4.3.4.2. A Global Phonological Condition. There appears to be a rule-particular condition on the surface form of the output of the *-en* affix discussed above. In addition to the already noted condition on its base (ending in *t* or *d*), Siegel (1971) notes that on the surface *-en* must be pre-

ceded by one and only one obstruent, preceded by an optional sonorant, preceded by a vowel (*glisten, harden, dampen, whiten, frighten*). (I know of only one exception to this remark: *brisken*.) This restriction cannot be stated on the underlying form of the base, for there are forms like *fasten* and *soften*, with underlying obstruent clusters, which do not reach the surface because of the application to them of a rule which deletes *t* after an obstruent and before *n*. Furthermore, the condition cannot be a surface one, since there are words like *Boston* which violate it. *Boston* is not a problem for the *t* deletion rule, which can be written in such a way as to generate it and others like it properly. However, it creates a problem for our restriction, which must now become either a global condition on the *-en* WFR, or an accident.

If we can find one other rule besides *t* deletion which serves the function of converting the output of the *-en* rule from a form which is not in accord with the canonical pattern into one which is. then we have evidence that the canonical form is less likely to be an accident, and that we are indeed dealing with a global constraint on *-en*, which allows us to generate a word in this suffix just in case the word reaches the surface in the correct form.

The rule which meets this description is somewhat controversial, for it concerns a segment which undergoes absolute neutralization: the one written *gh*, presumed to be a velar fricative. Arguments for the existence of this segment as an underlying phoneme of English are given in SPE (233–234) and Pope (1972). The rule in question deletes *gh* before *t* in words such as *lighten*, *frighten*, and *straighten*. Believing in the rule presupposes our believing in the possibility of absolute neutralization, but if we do, then this is evidence that there is a global phonological constraint at work in the derivation of words in the suffix *-en*.

4.3.4.3. A Transderivational Constraint. A remark of Pope's, and of Siegel's, which the latter attributes to Morris Halle, suggests that a device even more powerful than the last is at work in the derivation of *-en* words. *-en* normally attaches only to monosyllabic adjectives, but there are several exceptions to this pervasive restriction. Pope notes that "*-en* attaches to the noun, rather than to the adjective, only when the adjective form would be unacceptable" (1972, 126). As instances of this she cites the words *heighten, lengthen,* and *strengthen. -en*, she claims, is attached to the nouns *height, length,* and *strength*, because they meet the pattern which *-en* demands, while the corresponding adjectives *high, long,* and *strong*, if concatenated with *-en*, would result in the forms **highen*, **longen*, and **strongen*, which are unacceptable because of the surface constraint.

Pope's remark, however, is not correct. There are instances of *X-en* where *X* is clearly a noun with no morphologically related adjective. They are *threaten*, *hearten*, and *frighten*. In addition there is *hasten*, which might be derived from *hasty*, but which is more likely to be derived from *haste. Frighten* may be semantically related to *afraid*, but the morphological relation is only tenuous. It thus appears that of the seven denominal exceptions to the *-en* rule, three and a half can be explained by Pope's remark, while three and a half cannot. Additional evidence is hard to come by. The only adjective/noun pairs which meet the necessary requirements (that is, where the noun but not the adjective meets all the conditions) are those in which the noun is in *th* and the adjective ends either in a sonorant or vowel, or in an obstruent

which is deleted in the course of a phonological derivation, i.e. *gh* or *ng*. The only pairs which meet this complex of criteria are *true/truth* and *slow/sloth* (the latter only if we are willing to stretch our tolerance). There are only two other monosyllabic adjectives in *ng* besides *long* and *strong*, namely *wrong* and *young*, of which one has no *th* nominal, and the other may be related to *youth*, though not by any rule of English. There are no other monosyllables in *gh* besides *high*.

Failing the possibility of any further evidence being procured, it would seem to be advisable, in this case at least, to reject the sort of device which an explanation like Pope's entails, despite the initial appeal of the explanation itself.

I would like to note in passing that in any case we are not dealing here with a phenomenon which is productive in any sense of the word. All the noun-based *-en* words are relics, dating from a time when the suffix was not so strictly adjective-based (except *frighten*, which is later). I have decided to separate word formation from word analysis just because of the fact that we run into such relics in morphology, as a result of the persistence of words. The case in hand proves the utility of such a separation, for it appears to be only in the analysis of relic forms that we must have recourse to the most powerful sorts of devices.

4.3.4.4. A Boundary Paradox. In one sense, this problem is illusory, and in another quite mysterious. On the simplest version of our theory, since + boundary affixes attach to underlying forms, and # boundary affixes to postcyclic forms, all the former should precede the latter. One should never find a + outside a #, for that would be paradoxical. Yet one does:

(52)

a.	b.
analyze#able	analyze#abil+ity
standard#ize	standard#ize+ation
govern#ment	govern#ment+al

The paradox disappears when we remember that most WFRs are still once-only rules, and that the boundaries are relics of this one application of a WFR, which encode its effect in the phonology. When it was added, the *#ize* of *standardize* was added at the postcyclic stage in the derivation of *standard*. However, *standardize* now has an underlying form: /standard#i:z/. The only postphonological WFRs whose outputs cannot be entered as underlying forms are the infixation and reduplication rules. Now, since *standardize* has a legitimate underlying form, we can perfectly well add *+Ation* to it. The same goes for the other cases. As long as we regard word formation as a historical process, which is not repeated in every derivation, there is no problem. The problem only arises if we try to reduce the boundary-WFR pair, in which the boundary is a marker left for posterity by the WFR, to a simple WFR, which then must apply in phonological derivations.

Note that we do predict that the above situation will never arise in the case of rules of reduplication and infixation, for they cannot be simply encoded into boundaries. A + boundary reduplication should never follow a # boundary rule. Again crucial data are very hard to come by.

Though the morphology of the forms of (52) is not problematic, the phonology is. The words of column (a) have the same stress as their bases, as is predicted by the fact that # blocks cyclic stress rules. However, this is not true of the words of column (b), where the main stress

is on the portion following the #, and the stress of the base is reduced to 3. A tempting solution is to reduce the # boundary on the cycle at which the + boundary is first scanned. This would account for the (a) items (where there would be no cycle on the affix) and the (b) items (where the rules would apply cyclically on the stem and second affix), the cycle being blocked on the first affix by the boundary, which, because it is erased by the last affix, does not block the cycle there. However, as Alan Prince pointed out to me, this entails that a word like *standard# ize+ation*, which would have on the last cycle the form *standard+iz+ation*, be treated on that cycle exactly like *improvis+ation*, which has no boundary adjustment. However, this is not so. In *impr*$\overset{3}{o}$*v*$\overset{1}{i}$*sation*, on the *ation* cycle, after stress is placed on $\overset{1}{a}t$, two further things happen. The Stressed Syllable rule places a stress on $\overset{1}{o}v$ (two back from a 1 stress) and the Explanation rule (which reduces a 1 stress which immediately precedes a 1 stress and is separated from it by no more than one consonant, or *rm*) destresses *iz*, which is then reduced to *ə*. The surface form is [$\overset{4}{\text{ɪ}}\text{mpr}\overset{3}{\text{å}}\text{v}\text{ə}\text{z}\overset{1}{\text{ɛ}}\text{šə}\text{n}$]. In *standardization*, however, the Stressed Syllable rule has not applied on the last cycle, for if it did it would produce the form [st$\overset{4}{\text{æ}}$nd$\overset{3}{\text{ɑ}}$rdəz$\overset{1}{\text{ɛ}}$šən], parallel to [$\overset{4}{\text{ɪ}}\text{mpr}\overset{3}{\text{å}}\text{v}\text{ə}$-z$\overset{1}{\text{ɛ}}$šən], which is incorrect. The boundary adjustment solution thus fails, because it predicts that all cyclic rules will apply on the "last cycle", whereas "in actuality" only some do.

Another solution is to simply treat *standard#ization* as two words, i.e. as a compound, as we did with *Kalamafuckinzoo*. This gives the correct output for all the forms of (52b): however, it does not accord with the facts of (52a), where the affix has in two cases no stress and in the other 3 stress (*st*$\overset{1}{\text{æ}}$*ndardize*$\overset{3}{}$). Why are the two columns not treated in a parallel fashion? Do we only invoke the Nuclear Stress Rule (in its compound version) in cases where there are two affixes? Is there something about monosyllabic affixes? I don't know. At present, then, the forms of (52) stand as an important counterexample to any known theory of English phonology, but not morphology. Formally, they are of a single type: *X#a+b*. They are not isolated exceptions, but represent large classes of words.

4.4. Summary

In this chapter we have developed the notion of a Word Formation Rule as an operation on a base, accompanied by various conditions on the base.

The base is a word, a member of a major lexical category. Each WFR specifies the unitary syntacticosemantic class of which its base must be a member. The specification of this class contains no disjunction or negation. The base is also a fully specified phonological entity of unique form.

The operation is both syntacticosemantic and morphophonological. It specifies the semantics of its output as a compositional function of the meaning of the base, and assigns the output to a specific major lexical category in a specific subcategorization. The morphophonological operation is phonologically unique, and takes place at one of these levels in the phonological derivation of the base: the input to the phonology, between the cyclic and word-level rules, or the output of the phonology. The operation also assigns a boundary to the affix it produces. This boundary is dependent on the level of the phonology at which the morphophonological operation applies.

Conditions, both morphological and phonological, may be specified on the form of the base. Phonological conditions may be either negative or positive, and they are absolute: only items which meet the conditions may serve as bases for the WFR in question. Positive morphological conditions are different. They determine the productivity of the WFR with different morphologically specified subclasses of the base. Productivity is also equated with coherence. The more productive a rule, the more coherent its semantics (in the sense of chapter 3).

5: Adjustment Rules

5.1. The Place and Role of Adjustment

It should be possible for the phonology to process the word which is derived as the output of a WFR. However, such is not always the case. Rather, in certain instances the output of a WFR must undergo adjustment before the rules of the phonology may apply. This adjustment is performed by a class of rules which change the segmental shape of designated morphemes in the immediate environment of other designated morphemes. These rules are morphological, but in a different sense from the one we have used so far.

Up to now we have been concerned with morphology as a syntactic matter: how words are built up. But the word *morphological* is also part of the vocabulary of phonology. Traditionally, there are two different kinds of phonological alternations. First there are the alternations whose conditioning factors are totally phonetic (phonological). These alternations are the province of phonemics (with, in the American tradition, other additional strictures such as biuniqueness; cf. Chomsky (1964)). Alternations which are at least partly conditioned by other factors are subsumed under the rubric of morphophonemics. This would include alternations which are restricted to certain syntactic classes, those which have lexical exceptions or are entirely lexical (governed by individual words), and those which are morphologically governed, either in that they take place only in certain (classes of) morphemes, or in that they take place only in the environment of certain (classes of) morphemes.

As we noted in chapter 1, one of the major differences between generative phonology and earlier frameworks is that the former does not distinguish between phonemic and morphophonemic alternations (cf. Halle (1962)). Within generative phonology in its most general form, each morpheme (and phoneme) has a single underlying phonological form. The phonology is then an ordered set of rules which converts this underlying form into a surface phonetic form. This set includes rules of all the types mentioned, and rules of any one type may be interspersed with rules of other types.

Our adjustment rules comprise a small class of those which were previously termed morphophonemic, namely those which are restricted to specific morphemes and take place only in the environment of specific morphemes. The claim of this chapter is that these rules may be isolated from the rest of the phonology and ordered before it.

The goal of this chapter is then twofold: both to establish the reality of the class of phenomena which have been grouped under the head of adjustment, and to show how adjust-