In this chapter, we have seen some of the basic motivations for, and techniques of, metrical phonology, and have seen how they interact with the analysis of syllable structure. Many important issues have been ignored, or just barely touched upon, including phrase-level stress and accentuation, the effect of segmental phonology on the establishment of the foot as a unit of constituent structure, and the effect of metrical structure on other prosodic systems, such as tone and vowel harmony. Some of these will be dealt with, albeit briefly, in the following chapters; others must, unfortunately, be left for readers to pursue in the literature.
Lexical Phonology

5.1.1 The theory of lexical phonology

Lexical phonology begins with a division of phonology into a lexical component and a post-lexical component. These sectors have also been called 'cyclic' and 'post-cyclic,' but the ineluctability of the latter term has become apparent more recently, since the lexical phonology now, on most views, contain non-cyclic parts as well. The post-lexical component has also been called the phrasal phonology.

The post-lexical phonology involves two major sorts of rule applications: (i) those operating crucially across word-boundaries or making crucial use of phrasal or syntactic structure, and (ii) those that fill in, specify, or refer to non-distinctive features – the 'sub-phonemic' rules, we might say. For example, the principles discussed in chapter 2 that govern the appearance of the stops and spirants in Spanish have both of these properties: they specify a difference that is not contrastive in Spanish, and they do so on the basis of a phonological (or phonetic) principle that is not sensitive to whether the context material is in the same word or a different word. Thus, we find the stop version of b, d, or g when a homorganic non-continuant sonorant precedes, whether it is at the same word or the preceding word.

The class of lexical rules is also composed of two subtypes. Lexical rules involve, first, those phonological adjustments that are fundamentally occasioned, or triggered, by the juxtaposition of morphemes, such as the velar softening of k in electric when the suffix -ity is added, forming electricity; cf. (1). We may also include here the shortening that occurs to the stem vowel of strong verbs when the past-tense suffix is added (e.g. pleaded, feedled, feelled, perhaps sayled). Second, there are those lexical phonological rules that perform the modifications in the segmental structure required when the underlying form fails to satisfy the phonotactic conditions that make a string a well-formed word, such as the condition that the segments all be assigned to well-formed syllables. In this second group we may include all the types of openness rules discussed in chapter 3 above, such as in Turkish or Sesayarese.

(1) Velar softening

\[ k \rightarrow s / \rightarrow \sim \]

Lexical rules, as their name suggests, apply within the lexicon, and hence before all post-lexical rules and without reference to any phonological material in neighboring words (see (3) below). The representations in the lexicon are described using only the distinctive, or contrastive, features of the language, and hence lexical phonological rules can make reference only to the distinctive features of the language, and to none of its redundant or predictable phonological foibles, such as the aspiration of stops in English. Similarly, since vowels in English, as in most languages, are non-contrastively voiced, vowels are not marked for voicing in the lexical phonology. It then follows that voicing cannot spread in an acidulatory way from vowels to neighboring segments in the lexical phonology, as has been suggested in various places in accounts that have been offered for post-vocalic voicing of consonants. The principles that lie behind this general move will be discussed further below under the rubric of the 'eliminate redundant features' principle of underspecification theory; we will refer to this as the first principle of underspecification theory.

A feature that is simply predictable within a language is barred from the lexical phonology by what we may call 'feature filters,' as in (2). In principle, these filters could take on more than a single segment. A post-lexical rule will fill in such predictable features (here, voicing).

(2) Conditions on the feature voice

feature filter: no voice specification with sonorants

- [voice]
- [sonorant]

Features may also be left unspecified underlingly in another way, and for another reason, only to find the feature specification filled in during the course of the lexical derivation. That is, it may be possible to rule out underlying specification of certain features in certain positions, though not by filters of the sort in (2), which are in effect throughout the lexical derivation. Certain kinds of underlying specification may be, and should be, filled in by the effects of lexical phonological rule. Thus a lexical phonological rule, which will typically act across morpheme boundary for reasons we turn to in just a moment, will also have the function of filling in a value of certain unspecified features. Thus in Zgoque, for example, there is a rule that voices non-continuant obstruents after nasals (see (4a)). To express the naturality of finding voiced non-continuants after nasals, we can leave the voicing underlyingly unspecified in such an obstruent, getting a free ride on (4a) to do the work of filling in the voicing specification. In fact, this gets at the heart of an important conception, changes that accompany the juxtaposition of morphemes created by the morphology (so to speak) are normal in the direction of what is somehow felt to be a simpler structure even as far as monomorphemic forms are concerned. However, this result would not...
force the post-nasal consonant to be underlingly unmarked for the feature [voice], something that we might actually want to do.

There is a good deal more to say about this, but in any event, the situation I have just described represents one current point of view regarding underspecification within lexical phonology, and we will return to the matter in section 5.1.5 below. In the meantime, we will use the phrase the second principle of underspecification theory to refer to the view that features should be left unspecified if a lexical phonological rule would be capable of filling them in.

Consider the case of the tense vowels in English, which typically (and most clearly in the case of mid-vowels) have an offglide. The presence of the y-glide in [eɪ], or the u-glide in [ow], is obligatory, and in no way contrasts within English with its absence; there is no tense [ɛ] or [ɔ] without the glide. Because no contrast is possible, the presence or absence is not phonologically distinctive (or contrastive), and hence it is not part of the lexical phonology. The rule or generalization responsible for the presence of these offglides is thus a part of the post-lexical phonology, and it follows that no such diphthongs can be created (or found, for that matter) within the lexical phonology.

The notion that only contrastive features play a role in the lexical phonology, and that feature combinations that are not permissible underlingly continue to be illegal throughout the lexical phonology, may suggest—quite correctly—that the output of the lexical phonology, the last stage at which these generalizations are in force, is roughly comparable to the phonemic level of traditional structuralism. This is in several ways a useful parallelism to bear in mind, though to at least one major respect the structuralist conception fails to match up: the lexical phonological representation is very much word-bound. It cannot, in principle or in practice, include in its domain of generalization any material outside the word. Thus, as rules of morphophonemics in pregenerative structuralist phonology could assign a given underlying morphophoneme to any of several distinct phonemes, but not to any particular allomorph, so too lexical phonological rules can have as their output an element that satisfies the constraints of the lexical phonology, even though in its actual phonetic form it may have to undergo some post-lexical rules that modify it in further ways.

5.1.2 The Elsewhere Condition

Work on lexical phonology, following Kiparsky (1982a,b), has put to considerable use a general principle which he has called the Elsewhere Condition (cf. Kiparsky 1973). The Elsewhere Condition states, in informal terms, that, when two principles of operation are in conflict at a certain point in the derivation, then the one whose domain of operation is more restricted has priority of action. For example, given the statement that all obstruents are voiceless in a given language, and the statement that all affricates are voiced, the latter will have priority over the former in the case of a particular alveopalatal affricate. Even though the affricate is indeed an obstruent, the effect or application of the first principle is
have the property of being able to change feature specifications when they apply across morpheme boundaries, but they may fill in feature specifications of segments left unspecified even within single morphemes; for example, the voicing of a stop after a nasal in the same morpheme in Zoque can be filled in by the rule in (4a). These points are often summarized in the following way: lexical rules are feature-changing in derived environments, but have only a filling-in function in non-derived environments. The first part of this statement is also known as the Strict Cycle Condition. The name is a bit cryptic, but it alludes to a conception of these facts as resulting from a principle that a rule must apply to phonological material at the first chance – the first cycle – or else for ever hold its peace, and must never return to that earlier cycle to have an effect. We will return to the notion of the cycle below, in our discussion of strata.

Kiparsky proposes, then, that lexical rules and lexical entries enter into an Elsewhere relationship during the lexical phonology – more specifically, within each stratum of the lexical phonology. The Elsewhere Condition would be dropped, he suggests, as a principle relating the final lexical entries with the post-lexical rules. Thus a post-lexical rule would be just as capable of changing a feature it found while trying to apply strictly within a word or morpheme as it would be to make a change across a word or morpheme boundary.

5.1.3 Structure preservation

The notion of structure preservation is an important one within lexical phonology. It is based on the idea that there are constraints on possible underlying segments in the inventory of a given language, and constraints on possible autosegmental associations, and that the same constraints that apply to underlying representations hold throughout the derivation during the lexical phonology (and that these constraints are then dropped during the post-lexical phonology). The particular conception of structure preservation presented in Kiparsky (1985) is one whereby rules whose output would otherwise violate a constraint on permitted phonological structures in the lexicon are prevented from applying. If there were a constraint against voiced labials in a language as in (5), for example, with voicing on a separate tier, then a voicing assimilation rule as in (6) would be blocked from applying to a sequence p-d, for example.

(5) * [ anterior ]
+ coronal

(6) voice
We may refer to this interpretation of structure preservation as change-inhibiting structure preservation, in the sense that, by including this principle in our grammar, we will insure that fewer natural changes, or changes of autosegmental structure, will occur than would have been the case without it. Any rule that would create a violation will be blocked from applying. This is not the only possible interpretation of the basic notion of structure preservation in the lexical phonology, and we will briefly explore some alternatives below, whereby rules that create changes must ensure that additional changes be made so as to go together, as far as is possible, that representations respect the various positive and negative conditions placed on them within the lexical phonology.

It is, in fact, difficult to provide clear examples of the change-inhibiting interpretation of structure preservation, in part because it becomes more important than ever to justify the precise formulation of the phonological rules involved. To illustrate this, we will look in some detail at a case study that has been offered in support of change-inhibiting structure preservation, and suggest that alternative views of the data are preferable, views that leave no work for this version of structure preservation. The point is an important one, bearing directly on the question as to precisely how rules apply.

Kiparsky (1985) presents the following analysis of Catalan in detail, based on work by Mascaró (1976). He would like to show that a lexical rule of nasal assimilation is responsible for the homorganicity of nasal+consonant sequences, such as bitents ‘twenty’, where both consonants are coronal. However, the [g] there is not just coronal: it is also dental, a non-distinctive feature of all Catalan ts, which the he has taken on derivatively, because nasals are homorgaically homorganic with a following consonant in Catalan. Liquids, on the other hand, are alveolar but also, not distinctively so. Thus, a phonetic contrast between alveolar coronals and dental coronals exists, but not distinctively or contrastively. Since the dentality of t is not distinctive, Kiparsky suggests, that feature could not have been assigned by the lexical assimilation rule: the feature that distinguishes dentals from alveolars is not yet permitted in the lexical phonology, since it is not distinctive. There must be two stages of nasal assimilation in our derivation. One assimilation rule is arguably lexical, on Kiparsky’s view, because it applies before a word-level rule that deletes certain word-final consonants in clusters; this sequence of rules, applying in a feeding order, creates the forms shown in (7).

The fact that the [n] in (7a) is alveolar rather than dental is a crucial aspect of Kiparsky’s discussion. The word-final t has been deleted at word-level, leaving behind a nasal that has been specified for part of its point of articulation, the part that is distinctive within the Catalan lexicon. The nasal in bin is thus coronal and non-high; it is distinct from ts and s, not to mention from p. But it is not yet specified as to whether it is dental or alveolar. This is not specified until the post-lexical default rules have a chance to apply. They assign coronal obstructant stops to a dental point of articulation, an assignment shared with a preceding nasal; but a coronal nasal (other than ts) that is not part of a complex segment is always alveolar.

So far, while this is an interesting treatment, it is an argument for underspecification, not for (change-inhibiting) structure preservation. No rule has failed to apply because its output violated a lexical constraint. This is the next, and for our current purposes, crucial, part of the argument.

Kiparsky proposes that the rule of nasal assimilation in Catalan is as in (8). In these structures, as on several occasions before, we have put the point-of-articulation features on a separate tier, and as before, we note that we will return to this matter in chapter 6. Rule (8), a lexical rule, is intended to account for the obligatory homorganicity of nasal-consonant sequences. Kiparsky explains that he understands his formulation to not to apply in case the skeletal position on the left is already associated to any features or autosegments that are incompatible with the change (by discharging, for example), a matter that becomes crucial in the post-lexical functioning of this rule, as we shall see.

One significant problem to focus on, however, is that (8) does not function to rule our lexical sequences of non-homorganic nasal+consonant sequences, since they would be unaffected by the rule. To the contrary, Catalan nasals simply cannot bear a distinctive point of articulation underlyingly when preceding a consonant word-internally. What we really need is two things: a restriction against assigning an
underlying point of articulation to a nasal that precedes a consonant, and a rule spreading point of articulation to just such nasals. We will return to this reanalysis in a moment.

Kiparsky suggests that there is a lexical restriction on the point of articulation that can associate with a nasal, disallowing any velar nasal  in a nasal consonant cluster, i.e. that is not immediately followed by  or  . He proposes the formulæ given in (9). This is the place

\[
\begin{align*}
(9) & \quad \left[ \begin{array}{c}
\text{[\text{-}back]} \\
\text{[\text{+high}]} \\
\text{[\text{+nasal}]} \\
\text{\text{\text{C}}}
\end{array} \right] \\
& \quad \text{C in an unlinked matrix}
\end{align*}
\]

where (change-inhibiting) structure preservation as such comes into the picture. The rule of nasal assimilation (8) will be tested to see whether its application may be blocked — to see if its output violates the condition in (9). In some cases, rule (8) applies at the phrase level (see (10) below); in other cases, involving  and  , it does not. The question arises as to whether preservation of the structure in (9) is the reason for its non-application in this latter class of cases.

But is (9), indeed, a proper statement of a structural property that must be maintained in the lexical phonology? Is it the proper way to indicate that  can appear only when followed by a velar consonant? I will suggest a more appropriate alternative below, but it is fair to note that there has been little serious effort, in either the generative tradition or any other, to develop a theory of natural phonological constraints on representations. If Stanley (1967), for example, offers certain formal ways of representing dependencies, it can hardly be said that an effort was made in the formulation to provide a means to represent commonly found constraints in an especially simple and direct fashion. In this book, we have attempted to take some steps toward providing such a formulation, with the (minimum, maximum) specifications of autosegmental association discussed in chapter 1, and, more importantly, the concept of autosegmentalization.

We shall suggest that the important structural properties maintained in the Catalan representations derive from licensing properties of the Catalan syllable, if it is correct, and if we are correct in taking these licensing conditions to be phonotactics of the word-level representation, then we do not have here a case of a condition that must hold pervasively throughout a derivation, serving as the basis for the inhibition of a rule's application. These syllable phonotactics will, instead, hold at the word level, and will only indirectly influence what is likely to arise as an underlying form.

We may briefly review the structure given in (9) that Kiparsky suggests is preserved through the derivation. He indicates that the filter should block structures in which there is no [+back] autosegment associated with a [+high] nasal consonant. It is the second principle of underspecification, the one eliminating the unmarked value of a distinctive feature from underlying representations, that necessitates this backwards statement, i.e. prevents a positive statement that such [+high] nasal consonants must be [+back], i.e. velar. Put another way, the second principle of underspecification prevents us from saying directly that velar nasals must be in a doubly linked matrix, which is what Kiparsky suggests is the crucial factor. We return to a licensing approach to the matter below.

In any event, Kiparsky proposes two lexical rules: (8), an assimilation rule, and (9), a filter.

There is now the phrase-level nasal assimilation process to explore. The facts, briefly, are these, following Kiparsky (1985: 95): an  hardly assimilates — it assimilates only to a following /l/ (10a); an  assimilates to any following point of articulation (10b); it does not assimilate at all, nor does  .

\[
\begin{align*}
(10) & \quad \begin{array}{ll}
\text{(a) assimilation of m} \\
\text{so[m] amics} & \text{we are friends} \\
\text{so[m] felics} & \text{we are happy} \\
\text{so[m] dos} & \text{we are two}
\end{array} \\
& \quad \begin{array}{ll}
\text{(b) assimilation of n/} \\
\text{so[n] amics} & \text{they are friends} \\
\text{so[n] pocas} & \text{they are few} \\
\text{so[n] felics} & \text{they are happy} \\
\text{so[n] grans} & \text{they are big}
\end{array}
\end{align*}
\]

Now, not all conceivable combinations of points of articulation of a nasal and a consonant can arise across a word boundary. The data available suggest that the generalization is that only the — the nasal literally unmarked for point of articulation, though licensed by the lexical phonology — assimilates with respect to the contrastive points of articulation, as Kiparsky argues. The only other post-lexical assimilation is 'subphonemic', i.e. not involving the lexically contrastive features of the language (the difference between a labial and a labio-dental, in this case).

However, the analysis employing change-inhibiting structure preservation achieves this end only indirectly. Kiparsky assumes (and I agree with
him here as well) that rule (8) applies in both the lexical and the post-lexical phonology; but if we adopt such an approach, we may need to account for various non-occurrences of nasal assimilation at phrase level. Kiparsky suggests, for example, that the reason the labial m does not assimilate to a coronal at phrase level in Catalan (we find [som dos] ‘we are two’; for example, with no assimilation of the m) is that nasal assimilation is ordered before the rule that fills in the point of articulation of d; hence there is no point of articulation that can spread to the m. m does not associate to a following velar across word boundary, either, but under the analysis in question this would be for a different reason, not because of the extrinsic counterfactual order just mentioned. In this case, the structure mbk would be as in (11), to which nasal assimilation (8) will not apply, Kiparsky suggests, ‘because the configuration [+high, +labial] is barred by a marking condition both lexically and postlexically’. Though we have seen a suggestion here that a rule is blocked because its output violates a condition, this is not yet structure preservation, since the condition is not one that can be (or at least, has been) motivated as part of the lexical phonology of Catalan.

\[
\begin{align*}
(11) & \quad [+\text{nasal}] \\
& \quad \text{blocked} \\
& \quad [\text{C}] \\
& \quad [\text{C}] \\
& \quad [+\text{labial}] \\
& \quad [+\text{high}] \\
& \quad /m/ \\
& \quad /k/
\end{align*}
\]

Kiparsky suggests that filter (9) can be appealed to account for the last remaining example of non-application of nasal assimilation at the phrase level, that which does not occur when n is followed by a palatal, such as l. Here Kiparsky suggests that the reason such assimilation fails to take place is quite different. On this analysis, if lexical filter (9) did not exist, then at the point in the phrase-level phonology when nasal assimilation was about to apply, we would find the structure illustrated in (12). Although nothing within this account would block rule (9) from applying, the suggestion is made that the post-lexical, phrase-level rules are

\[
\begin{align*}
(12) & \quad [+\text{nasal}] \\
& \quad [\text{C}] \\
& \quad [+\text{high}] \\
& \quad [+\text{high}] \\
& \quad [\text{back}]
\end{align*}
\]
In Catalan, as in English, there is no underlying segment y. That is to say, the structure in (14a) is possible where the broken line associating [velar] with the nasal position is not present underlyingly, and is filled in only later), though that in (14b) is not. As we have seen, and as (14) illustrates again, the notion of licensing explicates how segments that are not allowed as underlying segments may arise by assimilation – even within the lexical phonology.

The use of (9) to block nasal assimilation via a change-inhibiting view of structure preservation involved explanations of why (8) did not apply to the w, the H, and the y that were produced through the lexical application of nasal assimilation. Kiparsky suggests that the proper conception of rule application is one in which an assimilation rule, of the sort we have seen in (8), will apply equally to underspecified segments and fully specified segments, being blocked only by the sorts of conditions as in (9).

Our view, however, is somewhat different. As we will explain in more detail below, we suggest that a large range of phonological rules are best understood when formulated so as to apply just in case their application serves to create a well-formed representation out of one that was ill-formed. If we distinguish here simply between an underlying representation, a level representing essentially the output of the lexical phonology (the word level), and the phrase level, we have a picture as in (15), with phonotactics of the sort in (16) defined at the latter two levels of representation, the word level and the phrase level. The establishment of phonotactics as in (16) makes it possible for the phonotactics to then trigger the application of such a rule as in (8). (16) makes explicit certain properties of the skeleton point-of-articulation chart, the chart on the horizontal plane in (14). This phonotactic indicates that all [+ consonantal] segments on the skeleton are freely associating segments in the point-of-articulation chart, and that at the phonetic level they must associate with a point-of-articulation autosegment. Put simply, (16) says that all consonants must be specified for point of articulation; rule (8) helps nasals that are in violation of that phonotactic to come into line with it.

(15) Underlying representation
\[ \vdash \text{rule (8) may apply} \]
- Word level: phonotactic in (16) is applicable
\[ \vdash \text{rule (8) may apply} \]
- Phrase level: phonotactic in (16) is applicable
Finally, we assume that, when a word-final m (a labial nasal) is followed by a word-initial labial consonant, as in the second example of (10a), the two consecutive, identical point-of-articulation autosegments merge to form a single autosegment, as illustrated in (17b). When the non-contrastive feature specifications are filled in, marking the continuant as a labio-dental, this information regarding specific point of articulation is shared by both consonants, the nasal and the continuant.\(^{50}\)

(17) (a) Sequence of m–f across word boundary

(b) Merger of two adjacent, identical consonants

(c) Post-lexical specification of labio-dental

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Lexical Phonology 233

It is worth pointing out that there is a close relationship between underspecification and the conception of structure preservation. In a framework in which segments are fully specified, if any single feature is changed, then the changes are good that the result will not be a permissible underlying segment; phonological systems are rarely so symmetric. For example, if, when voiced, an s becomes not z but r, then all the other features other than just voicing that distinguish an s from a z (e.g., [sonorant]) will have to be changed as well, if structure preservation is to be maintained. On the other hand, if only a small number of distinctive features are specified, then rules that take away feature specifications will always (or almost always) be structure-preserving (since even the totally unspecified segment is going to become something, either a t or a glottal stop, or whatever, as the language chooses). Rules that add features will also tend more frequently to be structure-preserving, especially if they are applying to a highly underspecified segment already.

Consider the case of Klingenstein's Law in Hausa, for example, according to which a p or t in coda position becomes a round glide æ.\(^{21}\) If p and t are underlyingly specified as [+continuant] and [+voice], then these features will have to be modified in the process; if the features are underlyingly unspecified, and filled in only post-lexically, then the deletion of the point-of-articulation features, and their replacement by the feature [+round] (assuming that that is the correct statement of the change) is all that needs to be said, as in (18). Note that the change here involves actual replacement of the features on the left.\(^{22}\)

(18) \([-\text{coronal}] \rightarrow [+\text{round}]\)

Consider the more complex case of Kuman, spoken in Papua New Guinea (Lynch 1983). If we look closer at this system, we find reason to conclude that, in the contrast between a plain l and a pre-verbalized gl, the latter is, surprisingly, the unmarked lateral in the language, and with a circumspect use of underspecification, the alternation between gl and l can be analyzed as a change of a single feature, [voice].

(19) p t k
    b d g
    s
    m n
    l gl
    w y

The segment transcribed as gl deserves special attention. It is a
velarized liquid, arguably a single segment, since it may occur in
syllable rhyme where no clusters otherwise appear. An underlying \( t \)
when in syllable onset position is realized on the surface as \( [r] \) excep
t word-initially, where it is realized as \( [l] \); a \( t \) in coda position is realized as
a \( [t] \) when \( n \) immediately follows, and as an \( [r] \) otherwise.

There is a phonological contrast between \( l \) and \( gl \), but there are
relatively few \( l \) at all in the language. Some are created by rule, from
a merger of \( gl \) and \( r \); others occur in borrowings. Lynch suggests that at
an earlier stage of the language there was only one liquid, which presumably
changed (perhaps in all positions except before \( l \) to \( gl \)). Subsequently, in a
relatively small number of words, a contrast has arisen between \( gl \) and \( r \);
but the majority of domains are of the velarized form. As we noted,
Lynch suggests that, synchronically, some \( l \) are created by a fusion of \( gl \)
and \( r \). Observe the imperative paradigms in (20) for the stems \( yu 'b ringing',
pr 'hear', and yagl 'plant'. The singular, dual, and plural suffixes are \( o,
\( r o \), and \( o \), and Lynch suggests that \( yu \) generally becomes surface \( [l] \).

(20) bring hear plant

<table>
<thead>
<tr>
<th>singular</th>
<th>yuo</th>
<th>pro</th>
<th>yaglo</th>
</tr>
</thead>
<tbody>
<tr>
<td>dual</td>
<td>yuro</td>
<td>priro</td>
<td>yaho</td>
</tr>
<tr>
<td>plural</td>
<td>yuo</td>
<td>priro</td>
<td>yalo</td>
</tr>
</tbody>
</table>

Let us assume that there is presently in Kuman a lexical contrast
between the velarized \( gl \) and the plain \( l \), and that an unmarked liquid will
be specified as \( [-\text{velarized}] \); post-lexically, An \( l \) that does not surface
as \( [gl] \) is lexically specified as \( [-\text{velarized}] \); that is, that feature is
lexically contrastive, but the unmarked value is positive, and is relevant
only to the liquids.

There are two rules in Kuman that devoice the \( gl \), making it a derived \( l \).
In the case of the output of rule (21a), a quite transparent rule, this
surfaces as a \( [l] \) (see (22)); in the case of (21b), a much more opaque but
still plausible rule, its surfaces as an \( [l] \), as \( t \) will do, as mentioned above
(see (22)).

(21) (a) \( gl \) \( \rightarrow \) \( t \) / \( \rightarrow \) \( n \)
(b) \( gl \) \( \rightarrow \) \( t \) / \( \rightarrow \) \( V \) \( gl \)

The following data illustrate both rule (21b) and a rule deleting \( gl \)
before \( r \), as well as several other processes that we will not focus upon:
several epentheses processes, including that of \( a \) between a \( b \) and a stop;
and voicing of the \( k \) in the indicative suffix \( ka \) in an environment that is
not entirely clear—after voiced consonants, and apparently after vowels,

(22) (a) stems with final \( gl \) with possessive suffixes ('my leg', etc.)

| "leg" | "bone" | "forehead" | "thing"
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1 sg.</td>
<td>kat-na</td>
<td>yobut-na</td>
<td>mabut-na</td>
</tr>
<tr>
<td>2 sg.</td>
<td>kat-n</td>
<td>yobut-n</td>
<td>mabut-n</td>
</tr>
<tr>
<td>3 sg.</td>
<td>kagl-e</td>
<td>yobugl-o</td>
<td>mabugl-o</td>
</tr>
<tr>
<td>non-sg.</td>
<td>kat-no</td>
<td>yobut-no</td>
<td>mabut-no</td>
</tr>
</tbody>
</table>

(b) stems with final \( t \) /bit/ "head" /piut/ "chest" /kot/ "navel"

<table>
<thead>
<tr>
<th>1 sg.</th>
<th>bit-na</th>
<th>piut-na</th>
<th>kot-na</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 sg.</td>
<td>bit-n</td>
<td>piut-n</td>
<td>kot-n</td>
</tr>
<tr>
<td>3 sg.</td>
<td>br-e</td>
<td>piut-e</td>
<td>kot-e</td>
</tr>
<tr>
<td>non-sg.</td>
<td>bit-no</td>
<td>piut-no</td>
<td>kot-no</td>
</tr>
</tbody>
</table>

but before epenthesis. The first-person singular subject marker is \( i \) with
vowel-final stems, such as \( yu 'b ring' \). There is a thematic \( n \) in the future
conjugations of vowel-final stems. The third-person singular \( u \) also
metathesizes to the right, as we see in (23). In these data, we see several
examples of \( gl \) becoming \( t \) before \( n \), by rule (21a); we also see the stem
final \( gl \) of \( yagl \) becoming \( t \) (which surfaces as \( [r] \) in onset position) before
the future morpheme -\( gl \), as when \( yagl-gl-ka \) surfaces as \( yaragka \).

(23) (a) Singular subject markers

<table>
<thead>
<tr>
<th>1st</th>
<th>2nd</th>
<th>3rd</th>
</tr>
</thead>
<tbody>
<tr>
<td>a/o</td>
<td>a/( i )</td>
<td>n</td>
</tr>
<tr>
<td>future</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(b) \( yu \) 'bring' /pr/ 'hear' /yagl/ 'plant'

<table>
<thead>
<tr>
<th>Aorist</th>
<th>1st</th>
<th>2nd</th>
<th>3rd</th>
</tr>
</thead>
<tbody>
<tr>
<td>yuga</td>
<td>yunga</td>
<td>ptinga</td>
<td>yamga</td>
</tr>
<tr>
<td>2nd</td>
<td>yungka</td>
<td>prukka</td>
<td>yaglkva</td>
</tr>
<tr>
<td>3rd</td>
<td>yunagka</td>
<td>pragka</td>
<td>yaragka</td>
</tr>
<tr>
<td>Future</td>
<td>1st</td>
<td>2nd</td>
<td>3rd</td>
</tr>
<tr>
<td>yunagka</td>
<td>yunagka</td>
<td>yunagka</td>
<td>yaragka</td>
</tr>
<tr>
<td>yunagka</td>
<td>pragke</td>
<td>prakga</td>
<td>yaragka</td>
</tr>
<tr>
<td>yunagke</td>
<td>pragka</td>
<td>prakga</td>
<td>yaragka</td>
</tr>
<tr>
<td>yunagka</td>
<td>pragka</td>
<td>prakga</td>
<td>yaragka</td>
</tr>
</tbody>
</table>

The question we may now return to is just what rule (21a) really looks
like. The change from the phonetic segment \( gl \) to \( t \) seems like it comprises
a goodly number of featural changes: \( gl \) is velarized, while \( t \) is not; \( gl \) is
voiced, while \( t \) is not; \( gl \) is a sonorant, while \( t \) is not. However, if we
Lexical Phonology

specify only the marked values of the distinctive features that specify gl, we can simply describe it as [+ consonantal, + sonorant]. It is, in the context of the consonant system in (19), the unmarked sonorant, just as t is, in that context, the unmarked obstruent: unmarked both for point of articulation and for all other secondary markings, such as nasality and voicing. (Recall that gl is taken to be unmarked for velarization, while t is specifically marked as [-prevelarized]). Thus the change from gl to t is minimal; it is the change from sonorant to obstruent. The 'structure-preserving' character of the change followed, more or less automatically, from the underspecification approach, since, as the point in the derivation where the change takes place, the phonological properties of the gl which would have to have been eliminated in order to make a t out of a gl are simply not specified. Regardless of whether or not rules may be blocked in their application by the principles of structure preservation, other examples do support the conclusion that the output of lexical phonological rules will normally negotiate in order to produce an output that is consistent with the word-level phonotactics of the language. Let us consider two kinds of examples that illustrate this a priori.

The first is illustrated by the discussion surrounding example (23) in chapter 1, where it was pointed out that a language (Sukuma, in the discussion there) may have a restriction on the number of association lines associated with a given vowel position, for example. In a language where the maximum is one, if a rule should reassign a tone to the vowel in question, the rule is not blocked from applying by structure preservation or anything of the sort (as Kiparsky's view would predict); as we saw in several tonal examples in chapter 1, the association line added by rule is preserved, and the association line that had previously been present is eliminated in order to maintain the constraint on permissible structures.

Consider another example of a similar sort, this time one involving elements that are less prosodic in character. Shaw (1980) reports a rule of vowel coalescence in Dakota, where the underlying inventory of vowels consists of the canonical five oral vowel system (i, e, u, o, a) and the canonical three nasal vowel system (u, o, a). When a nasalized /a/ is followed by a front vowel, the result is a high front nasal vowel, and when it is followed by an /a/ (no examples of /u/ are given), a high back nasal vowel is formed. (I simplify the matter of boundaries, which is irrelevant to the point at hand.)

As Shaw points out, this process is remarkably similar to another rule that he motivates, simply deleting an oral /a/ in the same context. In that case, the mid vowels that remain behind, so to speak, do not need to be raised (e.g. /ka + epka/ > [kepka]). But there are no nasal mid vowels in the inventory of the language, so when the /a/ is lost, and its nasality is preserved (an instance of what we called 'stability' in chapter 1), the result is a nasal mid vowel. But there are no nasal mid vowels in the inventory of underlying or word-level vowels in the language, and so it is not surprising that the result that would independently be expected – the gl nasal mid vowel – is modified immediately to form a nasal high vowel, which is a possible word-level vowel of the language. If, in line with the discussion of vowel features presented in chapter 6, we take mid vowels to be specified for the feature [low] and high vowels not to be, then the result described here can be viewed as quite similar to the tonal case sketched above. Dakota has vowels that are specified [+round] and [+low], i.e. /u/, and also those that are [-round] and [+low], i.e. /a/. It also has vowels that are specified as [-round] and [+nasal] /i/; but it has no vowel that is [+round] and [+low] and [+nasal], i.e. a front, mid, nasal vowel. When [+nasal] is associated to a vowel that is [+round] and [+low], the combination is not allowed, and one of the previously associated elements (in this case, the feature [+low]) is removed, allowing the resulting combination ([+round] and [+nasal]) to remain.24

5.1.4 Strata

In addition to dividing the rules of phonology into the two major classes of lexical and post-lexical rules, lexical phonology allows for the lexicon to be divided into what are called strata (or, interchangeably, level or layer), as we had already seen in the basic architecture given in (3) above. This division affects three major and distinct points. Through the formal use of strata, lexical phonology makes claims about (i) the reanalysis of what once were called phonological boundaries; (ii) the ordering of morphological elements, i.e. affixes; and (iii) the cycle in phonology. We will return to the notion of the cycle in section 5.2 below, and so will not discuss it here, except in passing and to define the basic organization of strata.

Strata are small compartments in which affixation processes and phonological rules come packaged together. They are linearly arranged, so that the first stratum has as its potential input (or domain on which to operate) the monomorphemic roots of the language. Each such root may undergo affixation of one of the stratum 1 affixes, at which point it will
have the opportunity to pass through all the strata of phonological rules, some of which it may chance to trigger. Now, clearly, the idea that morphological affixation simply 'happens' to a form as it passes through the strata, as if by chance, is not a very appealing metaphor; but since this is more a theory of the interaction of morphology and phonology than of morphology per se, we shall have to bear with it. There certainly is no very sensible way to think of the affixation of various derivation suffixes as being triggered, as it were, by some cloud of meaning that is hanging over the stem waiting to be 'realized' by some affixation process. We cannot attach a meaning to a morphological root, and pass it through a morphological flow chart, expecting it to pick up just those suffixes that allow the expression of this meaning - certainly not in the case of lexical meaning expressed by derivational morphology. In any event, the point is simply to acknowledge that this is not a good way of thinking about derivational suffica tion as far as its connection to meaning is concerned, but it will have to do for our expository purposes.

Strata themselves may be either cyclic or non-cyclic, though the former has often been assumed to be the normal case. In a cyclic stratum, as in (25), as each affix is in turn added to the base by morphological processes, the entire set of rules of that layer will have an opportunity to apply. In a non-cyclic layer, the phonological rules of the layer will not apply until all the affixes of the layer have been attached.

As a form passes through a stratum, it is bracketed in a way that shows its history within that stratum (see (26)). These brackets are not labeled.

(except perhaps insofar as a left bracket differs from a right bracket.)

At the end of each stratum, all the internal bracketings are dropped, so that rules of a given layer can never make reference to any internal structure that was created on an earlier stratum. To use traditional terminology, if in a given language the stem is created by the first stratum, and the word is created by the second stratum, then the morphology and phonology of the second stratum can make no reference to any morphological boundaries strictly inside the stem. Likewise, the post-lexical phonology can make no reference to any word-internal boundaries. This restriction is called the Bracketing-r Visibility Principle in the literature. This leads to an important position within lexical phonology: phonological representations do not contain labeled boundaries, such as the + and \# of Harris (1951) of Chomsky and Halle (1968). Instead, there is a nesting of domains defined entirely by the morphology, from the root outwardwards, as in (27), for example, and the rules of the phonology will be able to look at larger and larger domains, starting with the smallest. The functions served by boundaries in earlier theories are translated into other functions, in other ways. (And of course, the translation is not utterly perfect, in the sense that it is not the case that anything that can be done the one way can be done the other: if this were so, why should it matter which way we did it?)

Let us first classify the principal functions of boundaries in phonologi cal rules. Using the boundary symbols of classical generative phonology, we may list four. (i) Certain rules apply only across morpheme boundaries, and we can express that by writing X → Y; (i.e., if certain rules apply only across word boundaries, and we can express this by writing X → Yi → Z. (ii) Certain rules apply only at word boundaries (typically, word-finally). (iv) Certain rules cannot apply across a word boundary. This last function can include two kinds of cases: one where the rule applies strictly inside words, but not into material that would be introduced with the \# boundary, and the other where the rule strictly refuses to apply outside of the phonological word. These various boundary-oriented phonological effects are treated in different ways in lexical phonology. If we take the morphemes intr-
Lexical Phonology
duced with a + boundary to be introduced on the first stratum, and those
troduced with a # on the second, then rules that must apply across a +
boundary become lexical rules of the first stratum, and the rule's failure
to apply to stratum 1 segments that are not separated by a + boundary
becomes the responsibility of the Strict Cycle Condition, discussed above.
Rules that apply only across true word boundaries have to have those
boundaries explicitly stated; but they will be, necessarily, post-lexical
rules, and there is a bracketing in the phonological string that indicates
true word bracketing. Thus we could write a rule whose structural
description is as in (28), as we have already seen in KiHunde; if applying
post-lexically, this means that the forms are separated by word-level
bracketing.

(28) V  [ CV
|  | H
|  | H

On the third point, rules that apply only at word boundaries can be
treated in more than one way. They can be post-lexical, with a word-level
bracket indicated, just as in (28). However, they can also be rules of the
last stratum of the lexical phonology. If the rule in some way involves
a feature that is not lexically distinctive, then it must necessarily be post-
lexical; however, if it does not, then it may be either post-lexical or
lexical.

Finally, a rule that cannot apply across a # boundary (in the older
terminology) may be reinterpreted in one of two ways. If it is a rule that
applies to stem material, though not across a #, then it may be a stratum
1 phonological rule, as with the rule deleting a schwa before vowel in
English. This rule deletes the schwa in budhda + tom, but not across a #, as in
Indian#ga + tom. On the other hand, the rule may be a stratum 2 rule, if it
applies more broadly inside a word, but not outside the phonological
word more generally.

One point that on occasion is not clearly made in the literature is that
the development of strata has been to some extent a way of formalizing
an increasing dependence of phonological rules on particular morphemes
without making the point explicitly, and this can be suspiciously, even
dangerously, misleading. An extreme case may make that clear. If there
were a grammar with as many strata as there were morphemes, then (all
other things being equal) whatever phonological rules the affixation of a
particular morpheme required could be assigned to the stratum in
question. So if, for example, there is a strong past-tense suffix -t in
English which triggers shortening of vowels (kept/kept, perhaps say/said,
and so on), and we call 'stratum 1?' the stratum that contains just that
affixation process, then the shortening rule would be made a phonologi-
cal rule of stratum 17, and would apply only to forms derived in that
stratum. In this extreme case, phonological rules would be directly linked
to particular morphological processes with no explicit and formal
indication of the fact. Lexical phonology embodies the hypothesis that the morphemes that
toggle particular phonological processes form a discrete and identifiable set,
and that the affixation processes corresponding to them can be ordered together as an uninterrupted series of rules.

The bulk of classical generative phonology is concerned with how
morphemes are modified when juxtaposed, and we have already seen,
during our discussion of the Elsewhere Condition above, that lexical
phonology is designed in order to integrate the proposal that a lexical
rule may restrict itself to applying only in a derived environment, which
is to say that a rule will refrain from applying in a context where all the
conditions for the rule's application are found strictly within a single
morpheme (or, more accurately, where all the conditions for the rule's
application were already found within that single morpheme in its
underlying form).

Interesting and intricate arguments have been made for and against
this Strict Cycle Condition. In any event, one of the central principles of
lexical phonology has been this limitation on lexical rules to a kind of
application that can change a feature specification only when it is
explicitly the addition of morphological material that has satisfied the
rule's structural description. But this general principle also follows, it
should be clear, from a rather different interpretation of the significance
of many lexical rules, in particular, the interpretation according to which
these rules are explicitly linked to morphological processes.

Let us take a brief look at the structure of the Bantu verb from the
point of view of a theory of lexical phonology. The first set of questions
involves dividing the phonology into the lexical and the post-lexical
phonology. Post-lexical rules in a Bantu language such as KiRundi
include the rule that affects adjacent vowels across word boundaries,
reducing them to a single, short vowel with the quality of the vowel on
the right, a rule whose effects were noted in chapter 1, in connection with
example (46) there. Within the lexical phonology, it is necessary to
consider whether the phonology or the morphological rules apply to
the division of the lexicon into two or more strata. Bantu languages support
a distinction between the processes that build a stem out of a root (or
'traditional'), on the one hand, and the processes that build an inflected
word out of a stem. These two aspects are described within a lexical
phonology with two distinct strata, one for each series of steps.

The first stratum consists of the suffixation of derivational suffixes of
the form V(C) (called 'extensions', in the Bantu literature) to a radical
that is typically of the form CV/CV. This series of affixations, with each step the formal expression of the morphosyntactic features associated with the suffix in question, leads to a verbal stem with the structure shown in (29). The domain thus defined is also the crucial domain for the assignment of tense-specific vocal patterns in most Bantu languages; in Kikundi, this includes a L-H (Low-High) melody used in subordinate

\[\text{stem} \quad \text{extension} \quad \text{final extension}\]

and negative clauses. In addition, when two vowels are juxtaposed within this domain, rather than being affected as they would be in the post-lexical component, they obey a different principle. The result of juxtaposing two vowels is a long vowel here, and if the first is the low vowel a and the second is a high vowel [i.e., u or i], then the quality of the composite vowel is a mid vowel otherwise like the second vowel; thus a+i becomes e, and a+u becomes o. For example, the root ha, meaning ‘to give,’ plus the applicative suffix ir, forms beer. The verb, in turn, is formed by prefixing inflectional elements on a second stratum. When vowels are juxtaposed on this second stratum, a distinct rule is invoked which again creates a long vowel, but one whose quality is fully determined by the vowel on the right of the input string. Thus a sequence a+i, if it exists, is its output, as in the sequence n+a+i+ som+e+r+a [sinosera] ‘I read for myself, precisely as in Luganda, a closely related language that we looked at in some detail in chapter 2. The morphological structure of the output of this second stratum will look like (30). By indicating no structure below the node marked ‘stem’—i.e., the output of the first stratum—I intend to emphasize the fact that bracketing erasure has made the internal structure of that sequence no longer linguistically visible. Thus a layered picture of the Kikundi verb might look like (31).

\[\text{word} \quad \text{subject marker} \quad \text{tense marker} \quad \text{object marker} \quad \text{stem} \]

\[\text{prefix object marker} \quad \text{prefield sense marker} \quad \text{prefix subject marker}\]

\[\text{word} \quad \text{phrase-level phonology} \]

\[a \rightarrow V \quad V \quad V\]

5.1.5 Underspecification theory

Underspecification theory involves several notions which have appeared in generative and non-generative theory, and which can in principle be accepted or rejected independently of the other ideas of lexical phonology, but which fit comfortably with the central ideas of the theory. I have already summarized the two core ideas of underspecification theory with the following principles. (i) First, eliminate redundant features from the lexical phonology—features that are not distinctive in a subpart of the set of inventory of underlying segments must not be expressed with segments in that subpart— they are ruled out by what we have called feature filters. (ii) Second, eliminate unmarked feature specification from underlying forms: in any given phonological context, each remaining (i.e., non-redundant) feature has an expected, or unmarked, value and a less expected, or marked, value; only the latter may be explicitly present in underlying forms. These two principles differ considerably, and represent two different types of underspecification theory. The line between them is as occasion a hard one to find, but if we
step back slightly, we should be able to get a clear grasp of the difference between them.\\012\\012
The first principle is in effect a set of restrictions on feature co-
occurrence. We saw in the case of Digo, the Bantu language discussed in
section 1.6, that there was a Low tone on all voiced obstruents on the
surface. This generalization is so strong and straightforward that we can
draw the conclusion that this Low tone is not in any way contrastive; it is
totally predictable. The 'eliminate redundant features' principle would then
force the conclusion in the analysis of Digo) that the Low tone is not present
underlyingly. In a model that distinguishes between a lexical phonology and
a post-lexical phonology, it would furthermore be predicted that this non-contrastive
Low tone is not inserted until the post-lexical phonology. Similarly, since voicing is
not contrastive among the sonorants in English, sonorants could not be
marked for voicing according to this principle.

It must be acknowledged that this principle (which seems in many
ways just like phonological good sense turned into an explicit principle)
is often difficult to apply in practice because one not infrequently finds
oneself in a situation where two distinctions (or features) are redundant
in a given description, but it is hard to see which one is logically
dependent (and thus predictable, and thus to be eliminated from the
description in the lexical phonology), and which is logically prior (and
thus to be maintained in the lexical phonology). For example, if a
language had a vowel system with just /i, e, u, o/, the front/back
contrast and the round/unround contrast would be difficult to untangle:
which one is contrastive, and which predictable? is a vowel in such a
language round because it is back, or is it back because it is round?
Typically, one must look deeper into the system to determine the right
way to analyze it.

Many cases present no difficulty at all. Voicing, for example, is rarely
distinctive among the sonorant segments of a language (the vowels,
glides, nasals, and liquids); and it is generally distinctive among the
obstruents, or a significant subset of the obstruents, as in English, for
example. Among the sonorants in English, then, voicing is non-
contrastive, and by the 'eliminate redundant features' principle it would not
be specified in the lexical phonology. It follows, then, that no rule of
lexical phonology in English can refer to the voicing of a sonorant in
English, either in the structural change or in the structural description of
a rule; an obstruent could not assimilate in voicing to a sonorant within
the lexical phonology precisely because the sonorants are not voiced
within the lexical phonology: they are redundantly voiced later, within
the post-lexical phonology. Generalizations of this sort may be stated in
terms of the feature given in (2) above, eliminating as ill-formed any
structure within the lexical phonology which is both [+sonorant] and
[+voiced] or [−voiced], for that matter. The rule that fills in the feature
[+voiced] for the sonorants in English must be a post-lexical rule, since
no structure within the lexical phonology would allow such a rule to do
its job, given the filter in (2). This situation will contrast with what we
find for the second kind of underspecification, in which we turn now.

The second core idea of underspecification theory goes one large step
further in reducing the amount of information stated in the deepest
representation. It proceeds along the following line of reasoning: Con-
sider a feature such as voicing which has been restricted by our first
principle from co-occurring with any [+sonorant] segment in a language
such as English. This leaves only the [+sonorant] segments, the
obstruents, for the feature voicing to co-occur with. A [+sonorant]
segment can be thus be either [+voice] or [−voice]. But therein too lies a
redundancy; for the obstruent in English must be the one or the other – it
must be either [+voice] or [−voice]. The second principle of underspec-
ification theory says that we must eliminate this redundancy from the
underlying form as well, and one of the two feature values ([+voice]
[−voice]; must be eliminated from the underlying forms, and must be
assigned by rule. This rule will be – and must be a lexical rule, however;
we will call it a lexical default rule. The main reason it must be a lexical
rule is that, most simply stated, it will be written just to assign the default
value of the feature (say, [−voice], in this case). This assignment must not
apply, of course, to segments that are already (e.g. underlyingly) marked as
[+voiced] – that was the whole point of this default rule, which
allowed us to conceive of the [+voice] contrast as being underlyingly
private. As we have seen, the Elsewhere Condition will give us this
result, if we take this rule to be a lexical rule, for the Strict Cycle
Condition says that a lexical rule will not change a feature value in a non-
derived context. Thus we see, even within the theory itself, there is a deep
and fundamental distinction between the two kinds of underspecifica-
tion. There is another, more traditional, vocabulary that can be conveniently
used to express this second principle. It can be viewed as an attempt to
view all feature oppositions as being underlyingly private, in Trubet-
koys (1967) terms, which is to say, involving an opposition between a
positive something, on the one hand, and nothing, on the other. Trubetkoys
distinguished between such an opposition and what he called an equipollent
opposition, in which both feature values play an
role in the phonology. The second principle of underspecification theory,
the 'eliminate unmarked feature specifications' principle, can be restated
thusly: all features are underlyingly private.

It remains an open question precisely to what extent this second
Lexical Phonology

position is correct, whether in its strongest version or in some weaker version, such as that there is a strong tendency to use features privately in the lexical phonology. The issue is a complex one, interacting with virtually every other theoretical issue current today, and, as I have indicated, the matter remains unsettled. The position adopted in this book is that, except for major class features, there is a strong tendency for features to be private underlingly, but under certain circumstances, when a language can reduce two private features to one equipollent feature, the language will opt for the use of a single equipollent feature. On this point, see further discussion in section 6.3.1. There is a second way in which the lexical default rules may be evaluated from the perspective of lexical phonology. We mentioned earlier that within lexical phonology, there is no special set of phonological redundancy rules apart from other rules; rather, all lexical phonological rules will function sometimes as lexical default rules, spelling out explicitly what is an unmarked 'expected' phonological sequence or structure in a language, and at other times as 'true' phonological rules, actually changing phonological features or structure.

A lexical default rule such as (32), which says that obstruents will be voiceless unless otherwise specified, looks especially like a default rule and not very much like a rule that will apply across morpheme boundaries, but only because the structural description of the rule is so small. Another example, though, is considered by Kiparsky (1982a), who suggests that rule (33) of trisyllabic shortening (cf. Chomsky and Halle 1968) expresses a generalization about morphologically simple forms.

(32) [-sonorant] → [-voice]

(33) Trisyllabic shortening

(a) V → [-long] / C_u [ V ] C_u V

(b) Long vowel Short vowel

- divine
- divine
- serene
- serenity
- opaque
- opacity
- omen
- ominous
- declare
- declarative
- derive
- derivative

Trisyllabic shortening, understood as a generalization across non-derived lexical forms in the language, suggests that it is much more common for a vowel to be short if followed by an unstressed vowel, if

that unstressed vowel itself is not word-final. Canada fits this description; steeple or nightingale does not. If we count relevant entries in a list of monomorphic English words, we will find, Kiparsky suggests (and I believe he is correct), that the majority will fit this pattern. Thus, short vowels, like the first one in Canada, may underlingly be unspecified for length: this literal 'unmarkedness' is interpreted as a statement regarding inherent complexity of any given underlying form. Any phonological generalization, like this one concerning the distribution of vowel length, which becomes a redundancy rule of the language is thus a rule of the lexical phonology, and will by the same token come to apply to morphologically derived items in a new way. Now they may not simply specify an underlingly unspecified feature; they may change an existing feature. Thus a long vowel, marked [+long] underlingly, will become short [+short] when the suffixation of a morpheme places it in the appropriate environment for trisyllabic shortening, as when divine is suffixed to form divinity - the second vowel of the word becomes short.

We may summarize the general trend in the following way. For any given feature, the language 'prefers' one feature value in a given context, and it is the function of the lexical rules to spell out this preferred feature value. This preference will show up both in terms of statistical predominance in monomorphic words, and in the changes that occur when affixes are attached. The prediction is, then, that the alternations that are produced when affixes are attached always make the resultant word 'simpler' or 'less marked' from the phonological point of view of the language - they never produce a more marked segment. That certainly is an interesting claim, and it is one worth discussing further; for, while it makes correct predictions in a good number of cases, one cannot say that the analysis of English given within the framework of lexical phonology has looked at the point closely. It is certainly not obvious that the presence of /'i/ in front of /'i/ is more natural and less costly in the underlying representation of an English word, as rule (11), velar softening, proposes. *King* is not obviously more unwindly than *sing*, though that is ultimately the position of lexical phonology. But it should be clear now that ultimately the clash of lexical phonology, and what puts it at odds with almost every traditional view of morphophonemics in the broadest sense is this: lexical phonology takes entirely seriously the idea that the principles that create systematic phonological changes in the sound shape of a base and an affix when the two are juxtaposed are no different in kind from the principles that determine the markedness or complexity for monomorphic structures. In the case of velar softening, for example, this seems unlikely. This unlikelihood is increased, it seems to me, by the fact that the vowel or vowels that trigger the rule are
vowels which, though we may casually write them as i, mirroring the
orthography, are typically schwa-like in quality. In fact, the locus
classicus on the matter is Harris (1951: 221), who observes that:

all morphemes which have members ending in /i/ when not before
i, have members ending in /i/ instead when before i; (e) opacity/paipacity; (c) in electricity...
In such cases, it is possible to say that all morphemes which occur
before i will in that position have members differing in certain phonemes from
the same members of the respective morpheme. . . . This statement has now
become a statement about *-ity rather than about electric, same, etc., since the
alternation does not occur before other morphemes which can be considered
phonetically similar to ity (e.g. we have no alternation before after, or, also
begin with it in: electric-al, same).

It is by no means obvious that the governing factor in the /i/ alternation of *electricity* is the high vowel quality of the
following vowel in close juncture. We will return to this question below.
Let us summarize our discussion in (34).

(34) (a) Absolute constraints on lexical representations
1. They hold throughout the lexical phonology, from
start to finish.
2. They eliminate the possibility of using either value of a
given feature.
3. They define what is a possible and what is an
impossible phonological representation in a language.
4. They are stated as static filters.
5. They express the 'eliminate redundant features' claims
of underspecification theory.

(b) Markedness statements about underlying forms
1. They gradually fill in unspecified values throughout
the lexical derivation, operating as ordered rules;
before their operation, the unmarked value of their
feature must be unspecified; after their operation, the
unmarked value is specified.
2. That is, they turn a privative opposition into an
equipollent opposition.
3. They define what is a 'better' (less marked)
representation, and what is 'worse' (more marked),
though they do not define what is 'good' (possible) or
'bad' (impossible).
4. They are no more and no less than the lexical rules of
the phonology; hence they may also serve to change

5.2 CYCLIC DERIVATIONS IN ENGLISH

5.2.1 The cycle

The cycle is one of those notions behind which lies a very solid and
reasonable conceptual core, but which has been used, often thoughtlessly,
in such a fashion as to make well-minded citizens highly suspicious of its
functioning in good society. We have already seen its formal side; we
have seen how strata can be organized in a cyclical fashion, so that
phonological rules have a chance to apply after each bout of affixation.
Let us turn from that to the other, more practical, side of the notion.
Every language has processes for making new words, typically by
affixing prefixes and suffixes, and if the base to which the affixal material
has already undergone the phonological modifications necessary to make
a well-formed word out of it, there will be a kind of benign pattern of
cyclicity, in the same that principles might have been necessary to
make the base into a word will now have to come into play in order to
make the combined structure a well-formed word; cf (35).

(35) Morpheme in its underlying representation

<table>
<thead>
<tr>
<th>Phonological rules (e.g. stress)</th>
</tr>
</thead>
<tbody>
<tr>
<td>[word-1]</td>
</tr>
<tr>
<td>[word-1] affix</td>
</tr>
<tr>
<td>[word-1] affix</td>
</tr>
</tbody>
</table>

The cycle played an important role in the formal system of Chomsky
and Halle's *Sound Pattern of English* (1968), but it was Brame (1974)
who first put his finger on a crucial point that the word is the unit that
functions recursively, and that allows for the benign cyclicality that is
illustrated in (35). This notion was taken up by Aronoff (1976), and
served as the basis for what he referred to as a word-based theory of
morphology, a point that was then crucial to the development of Strauss
(1979) and Kiparsky (1982a).

Harris (1982) provides an excellent and precise illustration of the
conceptual core of the notion of a word-based approach. He observes that in Spanish, the root desdedh- 'disdain' is not a word, and therefore is not subject to the word-level restriction that forbids word-final palatal nasals /h/ in Spanish, desdedh is a morpheme; words, not morphemes, are the targets of such constraints as are embodied in rules such as (36).35 The root desdedh appears in the verb desenibir and its related inflected forms, including the second-person singular subjunctive desdedh, which derives from a stem desden-

hence is not subject to rule (36). On the other hand, the noun desden 'disdain' (and the plural formed from it, desdenes) is derived from the root desden without the thematic vowel, and hence rule (36) applies to the underlying form desden/ which is trying to become a word, forming the surface form desden.

We have, then, the result of benign cyclicity: the theoretical result of claiming that (at least some) morphology is word-based, which is to say that it is constructed out of already formed words. Other notions of cyclicity would arise from a claim that rules applied cyclically to domains that were not independently mappable as words. We shall not explore this apparently unnecessary notion here.

When correctly understood, then, the notion of cyclic derivations derives from the idea that certain morphological processes that produce words may themselves take as their input certain objects that have already been turned into well-formed words. Certain generalizations that involve word-level units may then hold both of the larger unit and the smaller unit, but ultimately this should be no more surprising or unproblematical than the proposition that main clauses may contain subordinate clauses.

As we shall see in some detail below, English contains many highly productive morphological processes that very clearly—one is tempted to say, ostentatiously—mark this cyclic character, with very distinctive indications that a word is contained within a word. Compounding is just one obvious example of this, but (as we shall discuss below) so is a certain kind of productive word formation based on the suffix -ism, as in Indianism [indianism] 'a way of speaking peculiar to people from India'. The larger word is clearly derived from the internal word by suffixation: [indianism]a.

Where a good deal of uncertainty has remained concerns those aspects of word formation in English where there is good reason to believe that two words are related, but the boundary (or 'juncture') between the base and the suffix is not clearly marked phonologically. For example, it certainly seems reasonable to believe that the words secrety and pres-

ideny are derived from the words secret and president, but at first blush one could hardly say that the case for such a derivation is transparent. The point is that, after all, even if presen
ty is derived from a stem desden-a (including the thematic vowel a) and as we need evidence that the base form president is being treated as a word, and is thus undergoing phonological rules as a word, before the affixation of the suffix for,

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ty is derived from a stem desden-a (including the thematic vowel a) and as we need evidence that the base form president is being treated as a word, and is thus undergoing phonological rules as a word, before the affixation of the suffix for,

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ty is derived from a stem desden-a (including the thematic vowel a) and as we need evidence that the base form president is being treated as a word, and is thus undergoing phonological rules as a word, before the affixation of the suffix for,
that supports a view that the word was processed first as a word before the affix was attached. In addition, as a highly related question, we may consider the case of whether, when two of those close-juncture suffixes are added successively, there is evidence that each stage is treated phonologically as a word, or whether we wait until both suffixes are added before applying the word-level rules and constraints. We return to this question with regard to English below, when we have looked at a few processes in more detail. We will see then that there is positive evidence in support of the cyclic view.

5.2.2 The vowel system

In this section we will look at English stress and vowel quality. Some aspects of the stress patterns of English words are quite uncontroversial once a few grounds rules have been made explicit. Other aspects of the problem require a deeper look at the complex morphophonemic alternations that arise when derived words are formed. One area where a simplification of these alternations can be achieved involves the sub-area of vowel alternations, and to understand that we must discuss the analysis of the English vowel shift and vowel reduction as proposed in The Sound Pattern of English (Chomsky and Halle 1968).

We must first distinguish between main stress (or equivalently, primary stress or 1 stress) and non-main stress (or subsidiary, or secondary, tertiary stress). All lexical items of a major grammatical category (noun, adjective, non-optional) have a syllable that bears main stress. Native judgments are sharp and reliable concerning which syllable bears the primary stress; the only shakiness concerns a handful of words where the primary stress may appear on either of two syllables. These words are typically unproblematic, with the main stress falling either on the first or the last syllable, as in cigarette or magazine. Primary stress can be identified by the high pitch associated with it and the low pitch found immediately following it.

Most words of more than one syllable also have syllables bearing a stress that is not primary. There has raged for decades a controversy as to whether these are distinctions among the stresses of non-primary stressed syllables. Some say that all non-primary stressed syllables bear the same degree of stress (“secondary stress”); others, following the Trager and Smith (1951) tradition, assign several distinct levels of stress. Virtually all of the work in metrical phonology (as well as in classical generative phonology) has followed the second assumption, though evidence in its favor is remarkably slim. The issue necessarily involves the treatment of long words, as a moment's thought makes clear, and judgments are extremely subtle. For example, it has been observed that there are two different possible pronunciations of the word Ticonderoga. In both, the main stress falls on the penultimate syllable, and in both the third and fifth syllables are unstressed. In both, the first and second syllables are unstressed, but the two pronunciations differ with respect to which of the first two syllables has higher stress. In the Smith–Trager tradition, these two pronunciations are represented

\[ 3 4 \quad 0 \quad 1 \quad 0 \quad 3 \quad 0 \quad 1 \quad 0 \]

Ticonderoga and Ticonderoga,

where '1' marks primary stress '3' a non-primary stress, and '4' a non-primary stress lighter than '3'. It is not entirely clear what status should be given to this observation. The difference between these levels of 4-stress and 3-stress in such words is clearly not contrastive, in the sense of representing possible lexical or morphemic contrasts. Some speakers apparently report perceiving one pronunciation; others report free variation. One analysis (Kiparsky 1979) bases an argument for a certain theoretical position on the fact that unanalyzed words, such as Ticonderoga, have two possible pronunciations (those just indicated), whereas superficially similar words that are derived from other, smaller words have only one possible pronunciation (for example, sensationality, where the first syllable may never be perceived as more prominent than the second, cf. also categorization, based on category, or ticonderogian, anticipation, or superiorly). Fortunately, most of the issues we will be concerned with do not involve the question as to whether there is more than one level of non-primary stress in English. Since the very nature of the facts themselves is unclear, what is most important is whether a syllable is stressed or not, for once it has been determined which syllables are stressed, it is generally easy to predict mechanically which syllable will be assigned the primary stress (Schane 1979b). Holding aside some special cases, the general principle is this: the highest stressed syllable that is not in the final syllable will bear the main stress. For example, the first and third syllables are stressed in both telephone and ethnographic, but in the first case, main stress falls on the first syllable because the last syllable is not a possible candidate for bearing primary stress. Once a syllable is added, as in telephonable, the third syllable can bear the main stress, because it is the ‘highest stress’ and it is not in the final syllable. This operation of main stress assignment can hardly be a clear example of a cyclic operation, of course, since the choice of main stress must await all suffixed syllables (or, more accurately, all suffixed syllables of a certain large class). Better to apply the operation just once, after all the relevant syllables are in place.

The distinction between a stressed syllable (which means, here and
vowels, so an underlying /e/ could escape this raising if the addition of a suffix to the morpheme containing a long vowel caused the vowel to shorten. For example, the second vowel of serene serene/ was unduly
long, and so the pronunciation serene/ shifted to the more modern serene/ (ignoring here the offglide). But the derivation of the word serenity involved affixation of the suffix /-ity/, and this suffixation in turn occasioned the shortening of the preceding vowel, producing the intermediate form serene/ity/. Here the second vowel has shortened, and so will fail to undergo the late rule of vowel shift (e → i). We will thus find, in the grammar of this stage of English, alternations between short [e] and long [i]. And this is still found in modern-day English, as illustrated by the alternations in (38), modified from a table in Halle

(38) Alternations involving vowel shift

(a) ay ~ [a] avenue/divinity
    crucify/crucifixion
    satire/satiric
    Christ/Christian/christian
    five/fifth/fifteen (but cf. nine/ninth, and eight/eighth)
    wide/width
    Palestine/Palestinian

(b) iy ~ [ε] serene/serenity
    intervene/intervention
    hygiene/hygienic
    deep/depth, health/health, steal/steal
    pleased/blessed, bleed/bled, feel/feet
    dream/dreamt, meet/meet, keep/kept

(c) ey ~ [ei] sane/sanity
    volcano/volcanic
    marginal/marginalia

(d) aw ~ [a] profound/profoundity
    pronunciation/pronunciation (and other words
    with -ence, like denounce)
    south/southern
    abound/abundant
    flower/flourish

(e) ow ~ [ə] verbose/verborious
    telephone/telephonic
    cone/conic
    harmonious/harmonic

(f) uw ~ [ə] reduce/reduction
Lexical Phonology

The position of The Sound Pattern of English (a position, as noted above, that is maintained by lexical phonology) is regular and productive, though the same can hardly be said for the back vowels (see especially McCall 1986). As I indicated above, the SPE analysis posits a regular phonological rule that recapitulates the historical change. Thus, the front mid vowel [ɛ] may be long or short, in the lexical phonology. If it is short it is also lax, and surfaces as [e]; if it is long, then it undergoes the vowel shift rule, and is raised to [i]. Eventually all long front vowels get a y offglide, by a late post-lexical rule. Finally, it is worth bearing in mind that, within the logic of the system, a long vowel that undergoes vowel shift may either be long underlyingly, never being shortened during the derivation, or be short underlyingly, and become lengthened during the derivation (e.g. marginal, marginal-ia).

The point of this discussion is to see how the SPE description encourages us to try to account for the phonological differences between many pairs of derivationally related words in a purely phonological way. The vowel quality differences noted in (38) can be abstracted away from if we can provide a reasonably small number of phonological rules that shorten or lengthen the vowels in question, leaving it a much later rule to effect the vowel quality changes.

But derivationally related forms in English differ not just in vowel quality, but also, quite frequently, in their stress patterns (e.g. compete, competition, atom, atomic). Lexical phonology, following a number of workers in this area, has defended the position that there exist phonological rules that shorten and lengthen vowels, and assign metrical structure after such length-affecting rules; further length-affecting rules will also apply after metrical structure has been established. The stress pattern of a morphologically derived English word, then, is claimed to be predictable according to the regular patterns established for monomorphemic words, except that some shortening and lengthening rules apply before the stress rules apply, and others apply after the stress rules. We will explore this by first presenting a brief overview of the principles of stress assignment for monomorphemic words in English.

5.2.3 English stress rules

We have looked at the basic operation of the English stress rule in our discussion of metrical phonology. Most work in lexical phonology is in agreement on the following main points of English stress.

The rule that assigns the rightmost stress to a word is the quantity-sensitive rule that we discussed in chapter 3 which assigns a foot — i.e. a stress — to the right-hand end of the word, skipping over extrametrical material and one light syllable, if there is one. However, a final syllable which is extrametrical but contains a long vowel will nonetheless be marked as stressed, i.e. will form a foot. This is possible primarily in the case of nouns, whose final syllable is extrametrical. Nonetheless, a final syllable with a tensed vowel will find that syllable stressed. In additional, certain adjectival suffixes may have this property of attracting stress, such as -oid and -ory.

Reviewing, then, from chapter 3, the stress pattern of the sorts of words in (39) will be predictable. If the final syllable contains a long vowel, as in (39d), that final syllable is stressed. Otherwise, stress falls on either the penultimate or the antepenultimate, depending on the weight of the penult. If the penult is heavy, as in (39b) or (39c), it is stressed; otherwise, as in (39a), the antepenult is stressed. A syllable, of course, can be heavy either by virtue of having a diphthong, or by virtue of being closed, as in the penultimate syllables of (39b) and (39c), respectively.

(39) (a) America (b) aroma (c) veranda (d) Navesone cinema halalika agenda magazine asparagus hiatus veranda synopsis javelin horus sense utensil

These principles have been called the Main English Stress Rule; they are followed by a related rule or set of rules that gives rise to something close to a pattern of alternating stress earlier in the word. The precise nature of these rules is crucial for the formulation of the arguments concerning the cyclic nature of English stress assignment, as is the precise formulation of the several rules of stressing that are necessary, as we shall see.

Hays (1982) argues that the principles of stress assignment involved here are as might be sketched in (40). He argues that the rule of stress retraction, which he calls Strong Retraction, is quantity-insensitive, while the rule of stress retraction, which he calls Strong Retraction, is quantity-insensitive,
unlike the Main English Stressed Rule. The arguments for this position are moderately complex, and reviewing all the arguments would require a book in itself; nonetheless, this assumption is crucial to one of the most often-cited arguments for cyclicity, which is essentially as follows. The words compensation, condensation, and compurgation\(^\text{39}\) have essentially identical surface syllable structures. However, only the third of these is stressed in a non-cyclic fashion, and the lack of stress on the second syllable, despite its status as a closed (and thus heavy) syllable, shows that the pattern of stress retraction leftward across the word will skip over a heavy syllable as it constructs metrical feet, as in (40); this is illustrated in (41). Thus retraction is not quantity-sensitive.

\[\begin{array}{c}
(x) \\
(\text{x x x x x}) \\
(\text{com pur ga tion})
\end{array}\]

But the stress pattern in condensation, it is suggested, has distinct stress on the second syllable, unlike both compurgation and compensation. This is the result of the stress (Row 1 grid mark) that appears on the second syllable of the base form, condense, arguably; no other factor could account for this distinct stress pattern.

There are two important distracting rules to bear in mind. Both may be viewed profitably as stress-clash-reducing principles. The first Hayes calls 'stress destressing'; mnemonically, we might refer to it as the 'bananabandanna' rule, because it is the rule responsible for the deletion of stress on the initial syllable of banana, which is originally assigned a stress pattern just like that of bandanna, as we see in (42). Prestress destressing (44), however, removes the stress from a (degenerate) monosyllable: foot which immediately precedes another foot, and which consists of a single, light syllable, thus removing the stress from the first syllable of banana, as in (43).\(^\text{41}\) This rule applies only when the syllable that immediately follows is the main stress of the word as a whole, giving rise to differences in the stress on the first syllable in pairs such as department versus department, or relax versus relaxation. In both cases the second syllable is stressed, but only in the first of each does it bear the main stress of the word, and only there is the first syllable unstressed.

Following the SPE analysis, this rule is often conflated with the process that shortens and devoices long vowels in such forms as explanation.

\[\begin{array}{c}
(x) \\
(x x x x x) \\
(a) \text{banana} \\
(b) \text{bandanna}
\end{array}\]

The second rule of destressing applies rightward, deleting a stress foot on an open, light syllable immediately following a stressed syllable. The effect of this rule is particularly noticeable in the apparent alternations it gives rise to in a suffix like -ory, which has a full stressed vowel in words like deprecatory, promissory, or equacotary, where the preceding vowel is unstressed, but loses both length and stress in words like advisory and iliacotary, where the immediately preceding syllable is stressed.\(^\text{42}\)

5.2.4 Strata in English

We have now completed a quick survey of the basic principles of English stress assignment, and we can begin to approach some of the thornier problems that arise in dealing with the question of the extent to which English derivation can be treated as cyclic phonology.

(1) A great deal is known about English morphology, and yet at the same time there is considerable controversy about how to interpret what is known. In this section I shall explain what the main dimensions are along which investigators have found differences in the affixation processes in English, and shall indicate several of the ways that have been suggested for integrating these observed differences into theoretically coherent programs, of which lexical phonology is one.

Let us start with a simple example or two. There are, it appears, two kinds of ways that suffixes in English can be found attached to their base. In the first, the base is an existing word, with a meaning, a stress pattern,
and a syllabification that it would have standing alone; and when the suffix is attached, it leaves that base alone, phonologically. This is most clearly seen in cases where the juncture between the base and the suffix forms a sequence that cannot be found within monomorphemic words. I have already mentioned a few examples of this sort. While we cannot have geminates word-internally, we find this in words like cooly, cleanliness, tailless. We cannot have non-high vowels followed by another vowel word-internally, but we find this in words like Indianism or Bermudaize. The same point holds for prefixes as well, yet we find geminates with the prefix un-: unnatural, for example. Following traditional terminology, we may refer to this as affixation with open juncture. Not all suffixes ever participate in this kind of juncture, as we shall see. It is a fact — and not a logical necessity — that, in all cases of affixation with open juncture, the base is an independently existing word, with a stress pattern that remains unchanged when affixed, and a meaning that is composed to form the meaning of the whole word.

Many cases of affixation exist, of course, where the base to which the affix is attached either does not exist as a tree standing word (e.g. paternal, plagiarize, inscrutable), or has undergone some segmental modification (e.g. buddhism, where a schwa has vanished, or jeopailize, where a y of some sort has vanished, or syllabic, where an l has vanished, or libidinous, where an o has vanished and an n has taken its place). Despite certain complications which we shall discuss below, it can be said that, in all of this second kind of affixation, the base plus the suffix together satisfy the phonotactics of monomorphemic English words, and that the global stress pattern of such words also satisfies the rules of English monomorphemic words. For want of a better descriptive term, we will call this close juncture affixation.

This distinction between types of affixation has been described and categorized in different ways. The most familiar view attributes the difference to a difference of the suffix, and labels the two types of affixation we have described as affixations of, respectively, stress-neutral and stress-affecting suffixes; or stratum 2 and stratum 1 suffixes; or # suffixes and + suffixes. From the examples we have looked at so far, it is not obvious, of course, that the difference in the kind of juncture is the responsibility of the particular suffix that was chosen — it may, after all, have been the base that determined the kind of juncture that occurred. Since it has been taken for so long to be the suffix that is responsible for the type of juncture, however, we should consider more carefully the pros and cons of this position. One argument that has been given for ascribing the juncture type to the suffix is that it has been observed that the same base can appear sometimes in close juncture with one suffix, and in open juncture with another:

Thus, goes the first argument, if the base were the object responsible for the kind of juncture we find in a suffixed form, no base would allow itself to be found in suffixed terms among different kinds of juncture. Therefore, it must be the suffix that determines the juncture type.

The second argument for handling the junctural responsibility over to the suffixes derives from trying to identify minimal pairs among morphemes, where one always comes with close juncture, the other always with open juncture. If juncture type goes hand in hand with the particular meaning of the suffix, then surely it would follow that the suffix is formally responsible for the juncture type. For example, there is a suffix -ism that marks characteristic speech forms, and which comes with open juncture, and a suffix -ism that indicates a philosophy, in a broad sense, with close juncture. This gives us a number of close and actual minimal pairs; cf. (45):

(45) Close juncture Open juncture
catholicism catholicism
Buddhism buddhism
communism communism
Indianism indianism

There is certainly something to this generalization, but most of what is right about it has to do with new formations that we might make up, not with existing words. If we make up a word with the speech-markers sense, we will, in all likelihood, employ a suffixation process with open juncture (Turkism, Yankeezism); but the other thing we might well do is attach -ism to a base ending in -ic, wherupon the ic will become ix, phonologically: gallicism, italicism, anglicism, sinicism (or sinicism?), and so forth. Which of these already exist and which have just been invented I am not quite sure, and that has to do with the fact that is not clear, to say the least, that this second group is an instance of suffixation with open (#) juncture. And there do exist a good number of suffixed -ism words that have close juncture but the manneirisms meaning, rather than the philosophy meaning, of which one is perhaps
Lexical Phonology

manners, depending on whether the base, manner, has the appropriate meaning (e.g. archaic, hebraism, perhaps rothaeism).

Thus, our generalization about the speech-forms sense of -ism always taking open juncture is not terribly strong; and, going the other way, cannibalism (although it may, irrevocably, have the speech-form sense) generally has the philosophy sense, but it has the stress pattern of the word cannibal with -ism attached as an open juncture — otherwise we would expect to get stress on the second syllable, as in calamity.

The point of this extended discussion is to indicate that the prima facie evidence in favor of ascribing to the suffix the determining role in deciding whether get open or close juncture in a particular base-suffix combination may be a bit hasty. After all, the first part of the argument as sketched so far is that there are bases that occur with both open and close juncture in different words. But it is not hard to find — and we have already seen — cases where what looks for all the world like the same suffix is sometimes attaching in close juncture, and sometimes in open juncture. We have seen such cases with the speech-manner -ism; the same point can be seen with the open juncture -ize in Bermudize and the close juncture in notarize, synchorize, or Catholicize. In the first two forms, a word-final /z/ is elided, a sight of close juncture, and in the third, the stress pattern has been modified drastically in the base. And perhaps it need not be said, but we should also be aware that the mere fact that certain suffixes (-ity, for example, as in sanity, divinity, or electricity) will not attach to certain bases (*tallity, *fidelosity) is no more a fact about the suffix than it is about the base; that is, just as one can generalize across the various stems that -ity will not attach to, one can generalize over the various suffixes that will not attach to (*tally, *tallious, *tallis, *tallible, and so forth).

(2) Historical interlude. In order to discuss current approaches, it is necessary to sketch a certain number of generalizations that have been noted in the literature, and which serve as the basis for most of the models currently under discussion.

Siegel (1974) followed Chomsky and Halle (1968) in assigning to each suffix a boundary, thereby claiming that the juncture that was found was grammatically the result of the choice of suffix. Some suffixes came with a # boundary, leading to close juncture, in general (though she did not use that term), and others came with a * boundary; she referred to these as class I and class II suffixes, respectively, and gave the examples shown in (46).

Siegel made the following observations. (i) Class II suffixes attach, with only a handful of exceptions,\(^{42}\) to independently existing words. Class I suffixes attach either to words or to stems, i.e. bound morphemes. (ii) Class I suffixes will occasion a shift in stress from the pattern found on the independently existing base word, whereas class II suffixes do not.

(iii) Class I suffixes can follow each other (e.g. histor-ic-al, illus-ter-n, in-deter-min-at-e-err-deter-min-ace-y), and class II suffixes can follow both class I suffixes (fratern-icy, transform-at-ion-less) and class II suffixes (weight-less-ness). Class I suffixes can never, however, follow a class II suffix (weight-less-ity, *fatal-ism-al) (though she will disagree with this point below). (iv) Certain class II suffixes place conditions on the stress pattern that independently exist on their base words; class I suffixes never do. (Siegel discusses the -al nominizing suffix,\(^4\) the -ate suffix, and the -ful suffix).

Siegel united these observations in the hypothesis that the synchronic phonologi-cal process of suffixation should be divided into two layers, with the stress rules applying after all class I suffixation but before all class II suffixation, as indicated schematically in (47). This proposal was quite influential, and led in an almost direct path to the construction of the model of lexical phonology. To arrive at the conception of Katz (1982a,b), the notion was needed in addition that the stress rules operate cyclically, after each of the class I suffixes is added,\(^{44}\) and that class I suffixes are simply the first-stratum suffixes. The class II suffixes could

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now be added on a later—or perhaps the second—stratum. Any stratum 2 process would leave unaffected the stress pattern of the derived word.13

Inherent in the model proposed by Kiparsky (1982a,b) is the idea that close juncture is what is produced by forms going through the stratum 1 rules; a form that has managed to get through the roster of stratum 1 rules will satisfy the word-internal phonotactics of English. Suffixes affixed in the second stratum are the sources of open juncture, for they are not subject to the stratum 1 rules that would be responsible for such affixation as the dehiscence of the schwa in Buddhism. Thus juncture is translated into strata, so to speak; word-internal phonotactics (which is to say, close juncture) becomes a matter of stratum 1 rule effects.

Determining which stratum a given suffix is in, though, can be harder than it may seem at first. This is apparent just from comparing the several lengthy suffixes that have been turned into this hypothesis (Siegel 1974; Allen 1978; Aronoff 1976; Selkirk 1982b); their classification of this basic point for various suffixes is by no means uniform. Selkirk is, for her part, explicit about the point that some suffixes are in both classes, but she suggests that the 'vast majority' of English affixes are clearly in one class or the other.

We should be careful in evaluating the result of being faced with suffixes that individually belong to both classes. On the one hand, it is true that individual suffixes do, in fact, come with different kinds of juncture, then we need a model that can recognize that, and treat it adequately, and not require that each suffix be assigned to one kind of juncture or affixation. On the other hand, assigning a suffix to both classes without independent justification can, under certain circumstances, be just a sign that the model is in trouble, and is making wrong predictions. Consider an example of the second sort.

The class I/Class II model in (47), and its descendants, make the strict prediction that class I suffixes never appear to the right of class II suffixes. Now, the suffix -ed is a clear case of a class I suffix, since it easily attaches to non-words (pattern-all), and changes the stress pattern of its base (parent-all). The suffix -ment, however, has to be a class II suffix as Siegel (1977) points out, only that assumption would give the right stress pattern for abolishment; for even if (in more recent terminology) the final syllable were extrametrical, we would expect the stress to fall on the penultimatum. Only if we let abolish derive its stress on the first stratum can the form be derived correctly. The problem is, though, that the sequence ment-ed is quite common, as we see in words like governmental, ornamental, elemental, supplemental, and so forth. Selkirk suggests that this shows that there are two suffixes -ment, one from class I, which appears in government and ornamental, and another from class II which appears in employment. Only the former can appear with the
can be reduced to the less striking statement that words are formed from other words, and that word-level rules can therefore have applied to subparts of words as well as to the whole word itself. But a cyclic account leads to some rather surprising results, as well.

We have seen that the metrical grid assigned to a given word forms a chart, the bottom row of which associates to the skeletal tier in ways that we have explored in preceding chapters. Hallé and Vergnaud (1987) have proposed that the notion of cyclicity in stress assignment be understood in terms of autosegmental charts as well. They suggest that each cycle produces a distinct metrical grid, associated to the skeleton, and that there are limited ways in which information can pass from the grid corresponding to an earlier cycle to the grid of the later cycle. 51 They suggest that in English, a word-level stress (that is, the main stress of a word, a grid mark on the third row) is copied over to the next cycle, though other (secondary) stresses are not copied. 52 This predicts a derivation as in (49) for the pairs of words condense, condenesation, in which the second syllable should be stressed in both forms.

5.2.5 The cycle in English

A number of arguments have been given for a cyclic account of English stress placement. As I indicated above, many of these rest on elusive data, but I will offer the following argument in favor of a word-based cyclic account of English stress. As noted above, the notion of benign cyclicity productively to adjectives, not to nouns; grammatical exists, but un- does not productively attach to nouns. Re-similarly attaches productively to verbs, not to nouns, and of course in case (48c), the adjectival form South American is based on the compound South America. 49 Strauss characterizes these 'paradoxes' as involving prefixes and suffixes, and it certainly does seem to be correct that it is difficult or impossible to assign to morphemes that flack a stem a relative order that is consistent with what we know about the rest of the language. 50 In the next section I will suggest further reasons for not incorporating level ordering into our account of morphology.
Lexical Phonology

fact, is based on the behavior of words with three simultaneous grid
charts, making the case even stronger.

Consider first the set of data given in (50), first discussed in Strauss
(1983), who points out that in (50a), there are a number of words formed
with the suffix -ic that do not allow for acceptable suffixed forms with
-ic, while in (50b), the forms are fine. In parts (c) and (d), we find
examples of trisyllabic words which allow -ic suffixation, and in (e),
forms that do not allow -ic suffixation.

(50) (a) zexic *sexistic
faddic *faddistic
rightic *rightistic
leftic *leftistic
rasic *racistic
rapistic *rapistic
paristic *paristic
(c) fatalic *falsistic
regalist *egalistic
humanist *humanistic
realist *realistic
commissarist *commissaristic

(b) sadistic sadistic
fascic *fascistic
linguistic linguistics
sceist *sceistic
theistic theistic
juristic juristic
sophistic sophistic

(d) masochistic masochistic
plagiarist plagiaristic
populist populistic
atheistic atheistic
apohist apohistic
bedouin bedouinic

(e) cartoonist *cartoonistic
escapist *escapististic
falangist *falangistic
alarmist *alarmistic
defraiser *defraiseristic
adventist *adventistic
conformist *conformistic
extremist *extremistic
reservist *reservistic
casserist *casseristic

Lexical Phonology

Strouze's restriction does not apply, allowing sadistic, just as fatalistic
is allowed, because although fatalist is built from an existing word, fatal,
that word does not have final stress.

This does seem, admittedly, like magic. The generalization is too
good to be true - almost literally, for, although the correct predictions are
being made, it seems impossible that one's own judgments could be
driven by Strouze's generalization. How, after all, could we have learned
to put such a suffix -ic and language-particular restriction on the -ic
suffixed form? Surely we must look deeper.

Let us step back a moment and listen to the impossible word
-alarmistic. What makes the word impossible is not too hard to
determine: it is that we cannot figure out how to stress it, because it feels
like we want to give the second syllable a word stress, and also the third
syllable, and we simply cannot figure out how to do both at the same

time, that is, with a single articulation - so we give up, and say it is
acceptable.

The problem, then, is clearly one of stress-clash, but how, and why?

Let us review a few things about stress-clash in English. First of all,
some stress-clashes are fine. There are many bisyllabic words where both are
stressed (e.g., nylon, nylon, nylon) and polysyllabic words with
adjacent stresses (Ilissia, Iliad, etc.). Mono- or monosyllabic words put
no major constraints on the pattern of adjacent stresses.

Furthermore, there are some kinds of suffixed that look like they
will lead to a stress-clash which is then resolved one way or the other
with no great difficulty - not every potential clash leads to the
phonological breakdown felt in alarmistic. A word like adnominate, for
example, with penultimate stress, has a pattern just like that of alarmist, but
because its stress is in an open syllable, it shortens and de-stresses when
the -om suffix is added, as in adnominate, which has (or can have) an
unstressed second syllable. A word like abnormal, again with stress
on the second syllable, does not have to lose that stress when the suffix -ic is
added, since it is in a closed syllable, but the stress on the third syllable is
clearly stronger (can be the stress, or the first syllable, or that of the
second syllable in abnormality. Both of these cases involve close juncture,
and neither seem to be troubled by stress-clash - in one case because the
stress is deleted, in the other because it is somehow sufficiently subordi-
nated.

There are productive morphological processes that clearly are directly
more sensitive to stress-clash, however, such as -alsuffixed. We have
already observed that the suffixed -als can be found with either close
or open juncture; the cases included catholicize and sentimentalize,
respectively. The task of determining which kind of juncture
we have here is not that easy, however. On any of the accounts of verbal
Lexical Phonology

stress assignment discussed in this chapter and chapter 4, the correct stress pattern can be obtained whether the suffix -ize is added on stratum 1, with cyclic stress assignment, or on stratum 2, even if we assume no application of the Main English Stress Rule (if we allow a rule to stress word-final long vowels in the second-stratum phonology). To see why, consider the case of a word like standardize or cannibalize. If stress is assigned to standard and cannibal on the first cycle, and then if -ize is attached on a second stratum 1 cycle, stress will be assigned to the final syllable (-ize) because it is heavy, and nothing further will happen. Stress retraction, discussed above (see (40)), does not apply when there are no 'unfooted' syllables, i.e. no syllables that have not yet been gathered into feet. In short, a monosyllabic verbal suffix (like -ize) is going to turn out not to affect the stress pattern of the base to which it is attached on stratum 1, just because of the way the English rules are set up, and because stress retraction obeys the Strict Cycle Condition, and thus does not change the metrical structure that it finds, but instead only applies to fill structure in. On the other hand, if -ize is a stratum 2 suffix, then all the more so it will not affect the stress pattern of the base to which it is attached, just by the way we have set things up: the Main English Stress Rule does not apply on stratum 2. So if we want to determine in a particular case whether we have open or close juncture with a particular -ize verb, and if we recognize that the decision may have to be made on a case-by-case basis, we can only conclude that stress will not help us in this task.

I suggest that, in cases of indeterminacy, the default assumption to make it that we have open juncture — that is, from the point of view of stratal ordering, a stratum 2 juncture. The judgment is a delicate one, but it is based in part on the following peculiarity.

The suffix -ize is highly productive, but it has some phonological limitations. Consider the forms and judgments in (51). The fact that we can autonimize an hearing system, for example, but not fallitize it, suggests two things. First, it affirms our decision to treat this as open juncture, since the vowel of autumal does not appear in this form; that is, we have a true word inside ([autummnize]). Second, it suggests that there is a phonological, not a semantic or pragmatic reason why we do not have fallitize. The generalization is a simple one, to be sure; -ize does not attach to a word with final stress, which includes all monosyllables. But should this be stated as a fact about -ize, or is it part of a larger generalization? In fact, it seems that this is part of a larger generalization that prohibits stress clash over an open suffix juncture.

We suggest that there is a prohibition in English against adjacent stresses across open juncture when the material on the right is suffixal (52). We label

[51]

(a) winterize
(b) alphabetize
(c) *Montrealize

*fallitize
*springitize
* *automatize
*departmentalize
* *NewYorkize
*Bostonize
*Chicagize

*radicalize
* !cartoonize
journalize
* !magazetize
* !reviewize
*bookize
* !philabize
* !legalize

the morphological bracketing with its corresponding phonological juncture type, open (#) or close (+). (Note that the prohibited clash involves successive syllables, not moras.)

[52] Prohibited: * foot + syllable

Such clashes are not prohibited, however, as long as they do not occur across an open juncture (which is written with a word-labelled bracket in filter (52)). As we have observed, stress-clashes word-internally do not offend the phonological sensitivities of the English language, nor are such clashes across a close juncture impossible, as abnormality illustrates.

With filter (52) in mind, we can return to the account of Strauss's generalization involving alarminic. The productive, word-based formation with -ist is again one with open juncture, just as in the case with -ize. That is the crucial point, for when we add the next suffix, -ic, stress will fall on -ist, yielding a stress-clash across open juncture. This is illustrated in (53).

As we observed, this account violates the Affix Ordering Generalization; class I suffixes follow class 2 suffixes, and in general I believe that is correct, and not theoretically ruled out. As indicated above, when the literature has faced this observation, the most frequent response to the perceived problem has been to say that a given morpheme can play the role of either a class i or a class II suffix. But as noted above, in reference to Selkirk's treatment of the problem of why meet-al will not attach to 're-standing verbs, that is a recognition of the problem, not a solution. We can now return to the problem now of why we find the pattern in (54), and can immediately see the reason why the forms in the third column of (54b) are bad. They are bad for the same reason that alarminic is bad: they require a stress-clash across an open juncture.

In summary, then, we have here an argument against the Affix Ordering Generalization, and thus against a stratal approach to English.
morphology and to lexical phonology.\(^{13}\) On the other hand, it is a positive argument for a cyclic and word-based approach to English stress assignment. What is crucial is the kind of juncture that is found between a base and a suffix: the default case is open juncture, since English adheres to a word-based morphology.\(^{14}\) Such a juncture does not cause restructuring of the metrical grid. However, open juncture does just that, while preserving earlier word main stress, as Halle and Vergnaud have elucidated.

In this short study of a few morphological processes in English, we have focused on open juncture operations. In the case of words built with close juncture, corresponding to stratum 1, or class 1, formations, the case must be built with considerable care, and we will not look much further into the details in this book. A certain amount of the discussion (e.g. Kiparsky 1982a: 35–43) might lead one to believe that accepting a cyclic account of these words necessarily means accepting accounts of words like hypocrisy, in which the first syllable is underlying long, and later shortened by rule, or presidency, which is formed by the suffixation of a y on stratum 1.

The fact is that the phonological effects of close juncture suffixes are quite varied, and are difficult to phonologize. Nonetheless, lexical phonology’s core idea does make a contribution to our understanding here, for there is a strong generalization lurking behind these analyses: the vowel length and stress modifications that are occasioned on the final syllable of a word by the suffixation of class I suffixes are changes that simplify the word, in the sense of making it look more like a mono-morphemic word. Lexical phonology’s premise – that the lexical phonological rules are one and the same with the set of rules defining natural underlying forms – states this direction of change correctly. The changes induced with suffixation are strong tendencies; a vowel in English tends to be short when followed by an unstressed vowel in non-final position, and we call the tendency in this direction ‘trisyllabic shortening’ (rule (33) above). When stems shift in this direction under affixation, we see this rule applying in a structure-changing fashion, though it may have exceptions, both scattered (such as obesity) and systemic (such as exploitative, since the diphthong oy will never shorten: it has no shortened form).\(^{17}\) This is an important result which any version of a lexical phonology must maintain in its theoretical core; and, along with lexical phonology’s contribution to our understanding of the importance of underspecification in the deeper part of the phonology, it forms the basis of a major contribution to phonological theory.
Notes to pages 197–198

16 Sources: (i) Wright (1971), and references there; (ii) McCarthy (1980); (iii) Kenstowicz (1980). See also Prince (1980), Wilden (1980).

17 See McCarthy (1979: 451–2), on Classical and Cairene, and McCarthy (1980: 96, fn 5), on Damascene. The former source suggests that final CVs are stressed in Cairene and unstressed in Classical Arabic. Kenstowicz (1980) is clear on the point that final CV syllables are stressed in Cairene.

18 Examples from Hayes (1982).

19 It is important here to focus here on the presence of stress, not the presence of main (word) stress. We return to the treatment of word stress in English in section 5.2.3, where we will see that the location of main stress in English is predictable once the (secondary) stresses have been placed, roughly speaking — the general pattern of rightmost stressed syllable that is not word-final receives the word stress.

20 I modify the form of his suggestions to suit the version of metrical theory we are employing here.

21 This accounts leaves open why long vowels in final syllables are unambiguously treated as heavy, surprisingly. However, as we noted in Chapter 3, the second half of the (long) vowel (or diphong) in English is normally in complementary distribution with the non-coronal obstruent in coda position; hence when both appear, the affix of the vowel must be in an appendix position.

22 In this respect, then, English differs from Arabic, where the appendix does not occur.

23 For example, on phrase-level stress, readers may look at the lengthy exposition in Hogg and McCulty (1987) and the references given there, including Hayes (1985), and Hakim (1985). See also the extended discussion in Nespor and Vogel (1986).

Chapter 5 Lexical Phonology

1 An early discussion of this is in Strauss (1982a), a revision of Strauss (1979). More influential have been the papers by Kiparsky (1982a, b), which developed a set of approaches to a broad class of traditional phonological problems, and Mohanan (1980, 1981, Peasey (1979) and Siegel (1974) were also extremely influential in the development of this approach.

2 Cyclicity of this sort is a hallmark of classical generative work, and was developed further in Arnott (1976), under the influence of Braine (1972a, 1974).

3 Readers skeptical about one or both of these rules are invited to wait for a discussion of the three principles below. The formulation given of velar softening in (1) is more for expository convenience than out of conviction with regard to the phonological evidence.

4 Readers may fairly be warned that this is a somewhat unorthodox reading of
difference between permissible and permissible sequences.

14 Kiparsky suggests just that, in prose (1985: 106): "[w]hen not assimilated, unspecified nasals ... are assigned the unmarked feature values... If we block these default values from being assigned lexically, the Elsewhere Condition will guarantee that they will not be assigned in the postlexical phonology until after nasal assimilation has applied there. If we take the filter in question to act like other lexical phonological rules, and enter into an Elsewhere relationship with the rule of nasal assimilation, then the filter will not block the assimilation rule, as needed, but in that case the filter will not block anything, because a lexical phonological rule is always overridden by the Elsewhere Condition, and a specific lexical evey 'overrules', in that sense, a lexical rule. If such feature filters do not participate in the Elsewhere relationship to lexical phonological rules like nasal assimilation, then the filter will block assimilation within the lexicon, which would undo the whole analysis. Of the two choices, the latter appears to be Kiparsky's theoretical position; cf. Kiparsky (1985: 98) where he says that feature filters should block the application of assimilatory rules, in accordance with the change inhibiting interpretation. We may consider a third logical possibility, and suggest that feature filters enter into an Elsewhere relationship with lexical phonological rules but not with lexical entries - saying, in effect, that lexical entries may not violate the feature filters, but lexical phonological rules are the same kind of theoretical objects, in the relevant respect. The correct solution to the present case, I will suggest shortly, is that no negative feature filter is required for most of the work, and the one that is request derives from the notion of autosegmental learning.

15 Kiparsky suggests that the principles of underspecification theory should surely not be taken to mean ruling out the possibility of specifically referring to the unmarked value. We believe that this is an important characteristic of an underspecification model of phonology, and that such references to unmarked values should in turn be ruled out. However, segmental properties that are unspecified for a particular feature (i.e. with respect to a particular autosegmental chain) may undergo assimilatory rules that other segments do not undergo in order to satisfy well-formedness conditions (phonotactic), such as that all consonants must be associated with a point of articulation at the phonetic level.

16 Put another way, the nasal segment that is still unmarked for point of articulation by the end of the phonology surfaces as an allophone.

17 There may be further restrictions on point of articulation in the codes this analysis is consistent with or without further conditions.

18 See the discussion of the Obligatory Contour Principle in ch. 6.

19 This conception of rule application is somewhat orthogonal to the subject of this book, which is the nature of representations rather than rules in phonological levels. However, the conception of rule application in lexical phonology as Kiparsky has proposed it incorporates the traditional SPS concept of rule application, which is precisely what is at issue here.
This division even suggests a natural difference in the phonological behavior of the two kinds of 'zero derivation' in English, the word-category change that can take place with no overt affixation, as in pairs like contrast (n.) / contrast (v.). In cases such as this one, where the two forms are either apparently of the same degree of 'baseness' in the language, or in cases where the noun appears to be derived from the verb, we find that the noun displays the stress pattern appropriate for nouns, and the verb displays the stress pattern appropriate for verbs. On the other hand, when a verb is clearly created from a noun, it retains the stress pattern of the base noun (e.g. to pattern, as in 'the adjective pattern with the noun phonologically', as we have already seen, a verb ending with two consonants would normally receive final stress, which is not the case here).

Selkirk (1982b: 104) cites Siegel (1977) as having drawn the same conclusion regarding the behavior of -ment, as I read Siegel, she proposes that the -ment of government is neither class I nor class II, but rather that there is a boundary symbol ($) inserted with all class II suffixes which can also irregularly appear in a few underlying forms. We may distinguish three kinds of morphophonological theories: the boundary-driven type, as in Chomsky and Halle, and Siegel; the rule-block driven type, as in lexical phonology; and the root-derivation labelling type, adumbrated in Selkirk and discussed further below.

An excellent discussion of this can be found in Axelsson and Sridhar (1983). I also have benefited from reading Badecker (1988).

See Axelsson and Sridhar (1983), Molkan (1986), and references there.

Williams (1981) proposes an account according to which the correct structure is the one parallelized by the Affix Ordering Generalization (i.e. [nt[grammatical]v]) and he suggests that structures of the form [xty] will be recognized by the grammar as being 'related' to other structures of the form $xty$. If correct, this proposal would have the amusing property of relating non-constituents in compounds as well, such as union suit and union suit-tailer (since the latter has the form [union suit (tailor)]). The former is a kind of garment; the latter a progressive worker. One can construct other examples of this sort, such as maternity suit and maternity suit-case.

Peasevsky (1985) discusses these problems from a different perspective, though my remarks in this section and the next indicate why I am not in sympathy with his particular solution to the 'paradox'.

An interesting precursor of this approach is seen in Chung (1953), who is concerned with choosing between transderivational constraints and cyclic accounts in the face of phonological processes in Chamarro that optimally take 'earlier cycle' stress specification into account.

Halé and Vergnaud actually achieve this through a mechanism of confusion of the second and third noun, essentially the same as what we referred to as suppression of secondary stresses. This leaves a grid mark on the second row only on the syllable with the main (word) stress, which is then copied.

We are using stratal terminology here, to be sure, though in the final analysis we will not conclude that it is appropriate to account for the present data.