In *A-Morphous Morphology*, Stephen Anderson presents a theory of word structure which relates to a full generative description of language. He holds word structure to be the result of interacting principles from a number of grammatical areas, and thus not localized in a single morphological component. Dispensing with classical morphemes, the theory instead treats morphology as a matter of rule-governed relations, minimizing the non-phonological internal structure assigned to words and eliminating morphologically motivated boundary elements. Professor Anderson makes the further claim that the properties of individual lexical items are not visible to, or manipulated by, the rules of the syntax, and assimilates to morphology special clitic phenomena. *A-Morphous Morphology* maintains significant distinctions between inflection, derivation, and compounding, in terms of their place in a grammar. It contains discussion also of the implications of this new *A-Morphous* position for issues of language change, language typology, and the computational analysis of word structure.
A-Morphous Morphology
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A-MORPHOUS MORPHOLOGY

STEPHEN R. ANDERSON

Professor of Cognitive Science
The Johns Hopkins University
For my teachers, and for my students
Linguistics will become a science when linguists begin standing on one another's shoulders instead of on one another's toes.
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The position described in this book has evolved over the past fifteen years or so, and is a continuation of the view known to some as ‘Extended Word and Paradigm Morphology’ (see Anderson 1982 and Thomas-Flinders 1981). This view has its origins in the insightful discussion of inflection and of the foundations of morphology in Matthews 1972, and also in the theory of Word Formation Rules of Aronoff (1976). It has developed through several seminars (on morphology, inflection, morphological change, morphology as a parsing problem, and word-internal structure) at UCLA, and owes much to the participants in those groups. Other courses at Stanford (on historical morphology in 1983, and on inflection at the 1987 Linguistic Institute) have also played a role, as well as a number of lectures and conference presentations. More recently, I have had the opportunity to present some of this material to my colleagues in the Department of Cognitive Science at Johns Hopkins, and also to a class at the 1989 Linguistic Institute at the University of Arizona. All of these audiences have provided valuable commentary and criticism, and I would like to express my indebtedness for the patience of these groups and the insights that they have offered me.

I would also like to express my appreciation to Mark Aronoff, John Goldsmith, Sergio Scalise, and especially to Norbert Hornstein, whose comments on portions of this manuscript have been particularly valuable.

Some of the material in this book has appeared elsewhere in other forms. Portions of the surveys presented in Anderson 1988a and Anderson 1988c have been cannibalized here and expanded into various chapters. An earlier version of the analysis of Potawatomi in chapter 6 formed the basis of Anderson 1977c. Much of the material in chapter 10 has appeared in Anderson 1989b, 1990c, 1990b. The historical discussion in chapter 13 is adapted from Anderson 1988b, though with some revisions. A version of chapter 14 has appeared separately as Anderson 1988d. An earlier version of chapter 12 was presented at the International Morphology Meeting in Krems, Austria, in July 1988 and appeared as Anderson 1990d in a volume of papers from that conference. I am grateful to the publishers of these works for their permission to use them in this way. The excuse for going over ground that has already
to a certain extent appeared in print is that many individual points benefit substantially from being presented in a more comprehensive context that makes clearer their relation to one another.

Material support for this work has come from the Research Committee of the UCLA Academic Senate, and from the National Science Foundation (grants BNS 84–18277 and BNS 89–10656). My research on K‘ak‘wala, which is reflected at various points below (especially in chapter 2) was supported between 1976 and 1979 by the American Council of Learned Societies, the Wenner-Gren Foundation for Anthropological Research, and the National Science Foundation (grant number BNS 78–15395). During 1988–1989, I benefited from a fellowship from the John Simon Guggenheim Foundation which allowed me to devote the major part of my attention to this work. I am extremely grateful to them, and to the Johns Hopkins University, for providing me with the time and facilities to produce this book. I will make no attempt to enumerate all of those who have contributed to my thinking about the issues discussed here, since that list would be more or less co-extensive with those I have known or whose work I have read over my career as a linguist; and I would be bound to leave some important people out inadvertently. Some will find their contributions acknowledged in the form of overt citations below; others may find their best thanks in the fact that I have not mentioned their names at all.
Introduction

As its title suggests, this book presents the major points of a theory of morphology and some reasons for viewing word structure in a particular way. Readers may legitimately wonder about whether the theory in question ought to bear a distinctive name, and if so, why this one: *A-Morphous Morphology*. In that connection, consider the following (probably apocryphal) story that was current around the MIT Linguistics Department when I was a student there.

One day one of the graduate students, who may as well remain nameless for present purposes, was talking with the chairman, Morris Halle, and asked him “What must I do to become rich and famous?” Morris’s reply: “Go forth and name things!” True or not, this undoubtedly represents a valid observation about the socio-politics of linguistics. Anyone who has been in the field for any length of time knows a number of cases in which the credit for some principle or theoretical position, at least in the general perception of linguists, went not to its originator(s) (insofar as it is possible to be clear who that might be), but rather to whoever first called it a principle, or a theory, and gave it a memorable name. More seriously, perhaps, we can take Morris’s observation as the recognition that principles and theories come into clear focus when their unity is recognized (or at least asserted) and a distinctive and unitary way is provided by which to refer to them. In that spirit, the theory described here has to have *some* name; and for a variety of reasons ‘A-Morphous Morphology’ seems appropriate.

It is to be hoped, however, that the view to be developed in the following chapters will prove to be a coherent one, so that the reader will not be tempted to see the name as denoting merely an amorphous or unformed theory of morphology. As opposed to that interpretation, there are several more systematic ways in which the word ‘a-morphous’ is intended to be appropriate. The first of these is the following: since it emphasizes the notion of morphology as the study of relations between words, rather than as the study of discrete minimal signs that can be combined to form complex words, it is literally a morphological theory that dispenses with morphemes. It is thus not a theory without form, but rather one withoutmorphs.
2 Introduction

On the other hand, the view of word structure as a system of rule-governed relations between words leads to the elimination of much of the apparatus of word-internal boundary elements and constituent structure common in morphological discussions. To take seriously the idea that there is a structured system of morphological rules within a language is to imply an organization for this system; and much of what is usually thought to motivate word-internal structure of a non-phonological sort can instead be viewed as a consequence of this organization of the grammar. The present view is thus a theory that minimizes the amount of (non-phonological) form that is assigned to words.

Finally, the theoretical position taken here stresses the fact that word structure can only be understood as the product of interacting principles from many parts of the grammar: at least phonology, syntax, and semantics in addition to the ‘lexicon.’ As such, this is not a theory that deals with the content of one box in a standard flowchart-like picture of a grammar, but rather a theory of a substantive domain whose content is widely dispersed through the grammar. Much current work assumes that a part of grammar is only a meaningful object of study insofar as it corresponds to an isolable ‘component of the grammar,’ usually enshrined in such a box. In contrast, the view taken here is that it is the existence of coherent principles with determinate scope that defines a grammatical domain, regardless of whether that scope can be localized in the way conventional pictures assume.\(^1\)

The task of a theory of morphology is to bring order and coherence to our understanding of the way words are composed and related to one another. We therefore begin by posing some basic questions about what motivates our opinions about the internal structure of words, and how the theory of word structure has arisen. If there is any point to having such a theory, however, it must be because there are entities or principles identifiable within it which do not simply constitute additional cases of what goes on throughout the grammar of a language. We therefore continue in chapter 2 by posing the question of whether morphology constitutes a serious and independent object of study at all. After all, as discussed in chapter 1, much early work within the generative paradigm argued that the two subparts of structuralist morphology, the study of allomorphy and that of morphotactics, were simply proper subparts of phonology and of syntax, respectively, without any autonomous status.\(^2\) The discerning reader will note that there are still twelve

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\(^1\) I should like to record here my debt to the late Osvaldo Jaeggli, who brought the importance of this issue to my attention with particular force in dealing with the 'place' of morphology in grammatical theory.

\(^2\) Actually, much structuralist work also accepted that syntax and morphotactics were essentially the same thing, though this tradition saw syntax as the natural extension of morphotactics, rather than the reverse. The distinctness of phonology from the description of allomorphy, in contrast, was a major point of principle in at least American structuralist theories.
more chapters of the book to go, and so will not be surprised to find that we
argue for the premise that there are indeed distinct principles that govern the
form of words. We then examine in chapter 3 the justification behind what
seems at first glance the only coherent way to talk about word structure: as
the analysis of words into constituent minimal signs (in a Saussurean sense)
called morphemes. We will argue that, whatever its surface plausibility, the
view of words as built up out of morphemes is fundamentally flawed, and
should be replaced by a rather different conception.

After establishing the integrity of the study of word structure and some of
its primitive terms, we then proceed to examine its interaction with other
parts of a complete formal grammar. First, in chapter 4, we discuss the extent
to which morphology and syntax interact, and thus the form in which the
Lexicalist Hypothesis (originating in Chomsky 1970) can be maintained. An
important issue in this connection is the nature of the interface through which
the syntax and the morphology interact. The notion of a Morphosyntactic
Representation serving as the content of the terminal nodes of syntactic
structures is developed, providing a narrow but non-trivial characterization
of this interface. In that connection, a set of inflectional processes in natural
languages is delimited and discussed. After the various aspects of a theory of
inflection have been laid out in chapter 5, the proposed theoretical apparatus
is exemplified in chapter 6 through an analysis of two somewhat different
complex inflectional systems: first that of the principal member of the
Kartvelian family, Georgian, and secondly that of the Algonquian language
Potowatomi. Despite the differences between them, both of these languages
provide an opportunity to pursue the virtues of a morphological answer to
a morphological question. Both display inflectional patterns that some authors
have taken as evidence of syntactic inversion, despite the absence of genuinely
syntactic arguments for such restructuring in either case. We will see that
within the framework of the present work, an alternative is available that
ascribes the morphological complexity involved to the right part of the
grammar. This chapter is quite dense, and may perhaps best be skipped on
a first reading.

In contrast to inflection, which involves rules sensitive to Morphosyntactic
Representations within Phrase Markers, derivational processes are argued in
chapter 7 to correspond to Word Formation Rules that operate entirely within
the lexicon (in one narrow but coherent sense of this term) of a language.
The structure and inter-relation of these rules is introduced on the basis of
typical exemplars.

A general issue in the treatment of word structure is of course the definition
of 'words.' If we took this notion to have a primarily phonological basis (and
there obviously is a phonological sense of 'word,' even if this is not the only
one or even the one most relevant to morphology), this would have the
Introduction

consequence that the class of elements traditionally called clitics should fall within the scope of principles of word structure. It is necessary, therefore, to explore the relation between clitics and morphology sensu stricto. In chapter 8, we argue that a significant class of clitics (the 'special clitics' in roughly the sense of Zwicky 1977) is in fact closely analogous to word internal morphology, as recognized in the claim that these elements are 'phrasal affixes.' The consequences of this analysis turn out to be quite extensive.

We then turn to the relation between word structure and the principles of phonological form. In chapter 9 we outline the reasons for accepting a version of the view of how morphology and phonology interact that incorporates some (but not all) of the theory of Lexical Phonology (see Kiparsky 1982a; Kaisse and Shaw 1985). In developing the basis for that view, we explore a related question: the status of non-phonological boundary elements in phonological representations. We conclude that an adequate theory of word structure and phonology can probably dispense with these entirely, reducing the phenomena which are said to motivate them to principles of the phonology.

The other sort of non-phonological structure which is commonly assigned to words is an organization of their constituent morphemes into a sort of Phrase Marker. The work of Selkirk (1982), Di Sciullo and Williams (1987), and many others has taken the description of such structures to be in some ways the fundamental problem of morphological theory. As would be expected, though, a theory that questions the status of morphemes in linguistic analysis has little room for such a construct, and we argue in chapter 10 that the operation of Word Formation Rules does not in general result in building structure of a non-phonological sort. There is, however, motivation for assigning internal constituent structure to the traditional class of compound (or in a more general sense, composite) words, and a class of Word Structure Rules (largely, but not entirely, distinct from the Word Formation Rules) is discussed in chapter 11.

Having characterized the principles of word structure and their relation to other parts of the grammar, we turn finally to three ways in which these principles can be viewed from the outside. The question of how much diversity languages can exhibit is typically posed in terms of a framework for classifying them typologically. Most current work on linguistic typology concentrates on syntactic parameters, but the development of reasonably comprehensive pictures of morphology raises the question of whether a coherent typological framework can be presented in this area as well. Starting from the most fine-grained of the pre-generative approaches to typological issues in word structure, the proposals of Sapir in his Language (1921), we ask in chapter 12 how the properties of traditional typological interest can be formulated in terms of the present framework. We conclude that in fact there is no
substantive difference between a significant 'typology' of linguistic systems in a given domain and an explicit, articulated 'theory' of that domain.

We then consider in chapter 13 the ways in which morphological structure may be the object of linguistic change, and the light that morphological change may shed on the principles of synchronic morphology. Some consequences of the view taken here of synchronic morphological systems for our understanding of language history are explored. Finally, in chapter 14 we discuss the problem of how knowledge of morphological structure of the sort this theory attributes to a speaker might be the basis of actual linguistic performance in the task of lexical access and word recognition. This is posed in computational-linguistic terms, but it is argued that the problems (and their solutions) which arise in writing a computer program to 'parse' morphological structure are more generally revealing of the principles of human linguistic 'computations.'

There are a number of aspects of the position developed here that are either somewhat novel or frankly iconoclastic. These include: the general rejection of the utility of the classical morpheme for morphological analysis; the claim that properties of individual lexical items (beyond their inflectionally relevant characteristics) are not available to syntactic operations, since lexical insertion takes place (effectively) at S-structure rather than at D-structure; the resolute assimilation of special clitic phenomena to morphology; and the claim that words do not in general have an internal morphological structure for phonological and morphological rules to refer to. Other points, such as the maintenance of a significant distinction among inflection, derivation, and compounding, may strike some as verging on the atavistic. Nonetheless, these things do all seem to form "un système où tout se tient," and I hope that the way in which the whole seems to follow from the nature of the facts of word structure in natural language will overcome the reader's fastidiousness about some individual details.

As will be clear from the above summary, there are many areas of inquiry concerned with word structure that are not explicitly addressed here. For example, such recent work as that of Dressler et al. (1987) and other representatives of the point of view of 'Natural Morphology,' as well as that of Bybee (1985), is not directly mentioned below. Much of this work is concerned not with the place of morphological principles in an explicit grammar but rather with principles that determine more or less preferred ways in which languages express particular categories, and with the substance of those categories. There are no doubt real and interesting concerns to be addressed in these areas, but they are not those of the present book. On the other hand, there are a number of other authors who have developed positions similar in many ways to that presented here (see, for instance, the recent work
of Mark Aronoff, Robert Beard, Arnold Zwicky, and others): the detailed ways in which the present view resembles and/or differs from those others will not be addressed except to the extent necessary to make clear just what our position is. Other deficiencies of coverage could be cited as well: it is an interesting commentary on the recent reawakening of interest in the structure of words that, whereas twenty years ago a survey of generative work in morphology could probably have been given fairly within the compass of a journal article, no single book can now hope to do justice to all that is going on today. Indeed, the pace of development of current work has led to the unpleasant circumstance that I cannot address the relevant material as quickly as it appears. To attempt to do so would postpone indefinitely the appearance of a book that has already been too long in gestation. I can only hope that the positions taken here are well enough developed to serve as the basis of some discussion. After all, in morphology (as in other areas of grammar), we never do get to declare that matters are sufficiently wrapped up that we can go to the beach.
The study of word structure

The object of study in morphology is the structure of words, and the ways in which their structure reflects their relation to other words – relations both within some larger construction such as a sentence and across the total vocabulary of the language. Traditional grammars saw the study of words and their relations as absolutely central to an understanding of the workings of language. The analysis of word structure was, in fact, the context in which most of the problems we now call ‘syntax’ and ‘phonology’ arose, and as such it is probably no exaggeration to treat morphology as the foundation of traditional linguistics.

During the past 125 years or so, a concern for morphology has been particularly characteristic of the “mature” phase of various theoretical currents in the study of language. For example, the early excitement and sense of revolution associated with neogrammarian work (and more generally, with historical Indo-European studies) arose from novel ideas about phonological structure and change; but subsequent developments brought attention back to essentially morphological questions in the work of de Saussure, and later Hjelmslev, Kuryłowicz, and Benveniste; and it is arguable that the most active continuation of that paradigm (in the work of Calvert Watkins, the late Warren Cowgill, and their colleagues and students) focuses most clearly on morphology.

Similarly, synchronic structuralist theory (especially in the United States) began by dropping the question of word structure – indeed, denying that there was anything of interest to study there – and concentrating on phonology to the exclusion of all else. Later, though, when the basic results of the ‘phonemic’ approach to phonology were considered to have been achieved, the methods developed there were applied to the study of morphology. Seen as the consolidation of insights already achieved in phonology, morphological issues gradually assumed a more and more central position in later structuralist discussion, in the work of Harris, Hockett, Nida, and others.

The same development from an initial lack of interest in morphology to the (re)discovery that problems of word structure have a character and interest of their own can be identified in the relatively short history of generative
linguistics since the 1950s. As we will discuss below, early generative views (typified by Chomsky 1957 or Lees 1960) assigned the internal arrangement of all linguistic elements within larger structures to the syntax, whether the structures involved were above or below the level of the word. The program of classical generative phonology, as summed up in Chomsky and Halle 1968, attempted in complementary fashion to reduce all variation in the shape of a unitary linguistic element to the effects of a set of phonological rules operating on a common base form; and this effectively reduced the (morphological) scope of the study of allomorphy to the listing of arbitrary suppletions. With nothing of substance to do in morphology, generative linguists had to become either syntacticians or phonologists.

By the early 1970s, however, both of these reductive attacks on morphology were in retreat. The program of generative semantics, within which 'syntactic' operations were responsible for organizing even submorphemic semantic constituents into larger structures, brought forth a reaction which was largely focused on the "Lexicalist Hypothesis," according to which words were to be treated as minimal, indivisible entities from the point of view of the syntax. The seminal work in establishing the importance of this claim was Chomsky 1970, though the actual assertion of that work was considerably more modest than its effect on the field would suggest, as we will see in a later chapter. Acceptance of the Lexicalist Hypothesis, however, brought with it the realization that if the syntax cannot combine morphemes into words, some other, independent mechanism must be available to do so. This re-establishment of the charter of the field of morphology was taken up in Halle 1973, the first work to establish the outlines of a generative approach to morphology as a distinct discipline, and Jackendoff 1975, where the relation between the lexicon and the syntax was made explicit.

The 1980s saw a growth of interest in morphology per se that can properly be called explosive. A number of (relatively) explicit theories of this part of grammar have emerged, and both syntacticians and phonologists have found it necessary to concentrate on the differences, as well as the similarities, between the proper domains of their work and that of morphology. Virtually everyone working in the general framework of generative grammar, indeed, would probably agree now that morphology is a distinguishable and legitimate object of study in linguistics. Whether it thereby constitutes a separate 'component' of a grammar is an issue of theoretical interest in itself, but the potential distinctness of morphological principles and vocabulary from those of phonology, syntax, and semantics is an area of active investigation rather than a mere logical possibility.

In the first section below, we lay out the basic question of morphological analysis and trace the intuitive path toward a set of apparently inevitable
1.1 How are words composed?

The question of what words are made up of is of course the basic problem in linguistic morphology. The immediate, and probably the most obvious, answer is the following: words are made up on the one hand of sounds, on the other hand of meanings, and they are essentially (and perhaps irreducibly) constituted by the relation they establish between sound and meaning. In fact, we will eventually argue (in chapter 10 below) that this first answer is indeed the correct one, but in order to get to that point we will have to pass by way of a number of alternatives.

The picture of words as direct associations between the meanings they express (their signifiés) and the sounds through which they express those meanings (their signifiants) is of course the familiar picture of Ferdinand de Saussure's minimal sign, represented graphically as in figure 1.1. The unity of sound and meaning in the sign was the fundamental point of de Saussure's theory of language as a semiotic system (see de Saussure 1974; Anderson 1985b).

When we consider words that are a little more complicated than the sign in figure 1.1, however, it quickly becomes clear that there is more to be said than is made explicit there. Consider a word like discontentedness, for example. We might explicate its meaning as something like "the state of being discontented." This involves appeal to the meaning of discontented, which we could then explicate in its turn as something like "characterized by notable discontent (N)." Again, the meaning involves reference to that of another form, the Noun discontent, whose meaning is something like "the opposite of content." This Noun, in turn, should probably be regarded as based on
The study of word structure

Figure 1.1 A Saussurean minimal sign

the Adjective content "satisfied." There are thus several layers of reference to meaning, rather than a single homogeneous association of a spoken form with some semantic content.

The point made by such an example is the following. At each stage in accounting for the meaning of discontentedness, we disengage a part of the sense and associate it with the relation between one word and another (presumably more 'basic') one. It will certainly not have escaped the reader's notice that in each case the other word is one whose form is included in that of the one being defined, in addition to their relation in meaning. This suggests, in fact, that there is a systematic connection between proper subparts of a word's form and proper subparts of its meaning. We might assign discontentedness a representation such as that in (1) below, where (1a) indicates the decomposition of form and (1b) indicates the parallel analysis of meaning:

(1)  
   a. \[ N [ A [ N \text{dis} [ N [ A \text{content}]0]\text{ed}]\text{ness}] \]
   b. \[ [[[\text{OPPOSITE-OF}}[[\text{SATISFIED}}]\text{STATE}]]\text{CHARACTERIZED-BY}]\text{STATE-OF-BEING}] \]

The correspondence between the two analyses of such a word suggests that (at least in the general case) the domain of the direct relation between form and meaning, represented in the Saussurean sign, is not the whole word but rather somewhat smaller subparts of words. If this case is at all typical, it suggests that a word like discontentedness is not a single sign but rather some structured combination of individually simple signs, each representing the unity of a discrete part of the word's meaning with a discrete part of its form.

On the basis of just such observations, the structuralist linguists of the 1940s and 1950s concluded that words are in general composed of such smaller
units, to which (following a terminological innovation due originally to Jan Baudouin de Courtenay) they gave the name morpheme. Morphemes, on this view, are composed of (or, as later morphologists would put it, realized by) phonological material, and they are also the bearers of linguistic meaning. Now, in fact, the structuralist picture of language was essentially that of a code, consisting of a large number of separate elements each with a distinct form and each encoding an element of meaning. To extract a particular message from its encoded form (including the special case in which the 'code' is the system of a natural language), the central task is to identify the distinctive meaningful elements within it, and then to reconstitute the message by combining their associated meanings. In this scheme, the 'morphemes' were the central elements of the linguistic code, and their analysis became a foundational problem for linguistic theory.

Now, in fact, when the structuralists came to the analysis of morphology, they already had a model for its study: that of the 'phoneme,' a minimal distinctive element of sound structure, as they understood it. Within structuralist linguistics, the 'discovery' of the phoneme was generally seen as constituting one of the field's major intellectual achievements, and it was quite natural to pattern the study of other areas on what had been accomplished there. While there were a large number of not easily reconciled conceptions of the nature of the phoneme (see Anderson 1985b), at least within American linguistics the dominant one in the late 1940s and early 1950s was probably that of a set of phonetic sound types in complementary distribution. In English, for example, one of the phonemes might well be /t/, which is realized as one of /tʰ/, [t], [tʰ] (an unreleased stop), [d] (a flap), etc., depending on the environment in which it occurs. The element /t/ itself, on this conception, is not a sound, but rather an abstract unit of sound structure — the name for a set of alternants, each with its own determinate conditions of appearance, as in figure 1.2.

In the process of interpreting the raw phonetic material of speech, the first step is to 'break the phonemic code': that is, to identify each of the phonemes, the distinctive elements of sound structure, which are represented in succession by phonetic segments.

![Figure 1.2 The English phoneme /t/]
If we assume that words are composed of minimal signs or morphemes, as suggested above, the phonemic model can be directly extended to accommodate morphological analysis. We can, that is, treat the morphemes of a language as the distinctive elements of word structure, and regard them as related to their concrete phonemic instantiations in the same way as phonemes are related to phonetic segments. As an example, consider the suffix found in the following Turkish words:

(2) a. hastadır “is sick”
   b. yorgundur “is tired”
   c. tembeldir “is lazy”
   d. kötüdür “is bad”
   e. açılır “is hungry”
   f. hoştur “is pleasant”
   g. geçtir “is late”
   h. küçültür “is small”

The suffix common to all of the forms in (2), whose contribution to the meaning of these forms is roughly to convert a descriptive adjective to a predication, has eight different phonological forms. In generative terms, the distribution of these variants would be treated as due to the operation of phonological rules: a rule of Vowel Harmony, causing the backness and roundness of the suffix vowel to agree with that of a preceding vowel, and a rule of DeVoicing, causing the initial consonant of the suffix to become [t] when following a voiceless consonant. Whether the relation between the morpheme and its alternants is rule-governed or not, however, we can regard this relation as holding between two different kinds of element: a distinctive element, the morpheme, and its concrete (phonological) realizations. This relation is shown in figure 1.3, where the individual conditions regulating the appearance of each variant are omitted.

Parallel to the terminology according to which the variants of a phoneme are called its *allophones*, the variants of a morpheme have often been referred to as its *allomorphs*. In this picture, a morpheme is now a (minimal) sign that has on the one hand a meaning, and on the other hand a set of allomorphs or phonological realizations.

An analysis of a given word in a particular language now comes down to the identification of its constituent morphemes. This is not quite the entire story, however, since these morphemes cannot be regarded as simply concatenated to form a complex word. This would be perfectly satisfactory

1 Note that the symbol i in Turkish orthography represents a high back unrounded vowel, the back counterpart of ı.
2 See reference grammars of Turkish such as Underhill 1976 for a fuller description of this suffix and its uses.
1.1 How are words composed?

for the purposes of describing phonological form, but the meaning of a complex word typically requires us to represent certain relations of scope among its components. This we could do by assigning words an analysis that includes a sort of internal hierarchical (or ‘Immediate Constituent’ [IC]) structure, such as that in figure 1.4.

Structuralist opinion quickly coalesced around a number of seemingly obvious propositions concerning word structure that are based on the notion of the morpheme as we have reconstructed it above:

(3) a. Every word is composed exhaustively of morphemes.
    b. Every morpheme in a form is represented by one and only one allomorph.
    c. Morphemes are arranged into a hierarchical IC structure (like figure 1.4) within the form.

This picture leads naturally to a division of the study of morphology into two parts. The first of these, which we can call the study of allomorphy, is concerned with the ways in which morphemes (considered as abstract signs) are related to phonological form: that is, with the nature of the principles governing the range of variation in shape shown by particular morphemes. Such a study is obviously closely parallel to the study of subphonemic or

\[ \text{Figure 1.3 The Turkish suffix \{-DIR\}} \]

\[ \text{Figure 1.4 Immediate Constituent structure of discontentedness} \]

\(^3\) At least as far as anything we have said up to this point. In fact, phonological considerations, too, require the imposition of some sort of hierarchical structure on the construction of words, as we will discuss in chapter 9 below.
allophonic variation in phonology. The second part of morphology, known as morphotactics, is concerned with the ways in which morphemes can be arranged into larger, hierarchically organized structures to construct complex words. Such a study involves the description of constraints on how morphemes can be combined, and is parallel to the study of phonotactic constraints on segment combination in phonology.

The history of this discussion has been rehearsed here not because it leads us to the central truths concerning the structure of words — indeed, much of the rest of this book is devoted to arguing that it is misleading and incorrect. Rather, the point of this summary of structuralist thought about morphology is that this was the picture of word structure which was inherited by generative grammar at its inception in the 1950s and 1960s. This picture also seems enormously seductive, indeed almost inevitable: once one recognizes the partial form–meaning correspondences in a word like discontentedness, all of the rest of the morpheme-based view covered above seems to follow as a matter of logic. We will suggest in the remainder of this work, however, that this is not the case, and that this picture can and should be revised in fundamental ways.

In any event, it was this structuralist view that dominated early generative thought about word structure. Early results seemed to indicate, however, that no part of structuralist morphology, neither the study of allomorphy nor that of morphotactics, corresponded to any distinct portion of the theory of grammar, and thus that there was no need for a theory of “morphology” per se.

Consider the study of allomorphy, for instance. Taking the facts of Turkish noted above into account, we have already noted that we might assume two phonological rules for this language: a rule of Vowel Harmony (which makes suffix vowels agree in backness and rounding with stem vowels) and one of DeVoicing (by which /d/ → [t] after voiceless consonants). But both of these rules are part of the phonology of Turkish, on generative conceptions. Structuralist accounts had to put the principles governing the shapes of the morpheme {-DIR} elsewhere than in the phonology, since the units which alternate according to the rules referred to (/i/, /u/, /i/, and /ü/; and /d/, /t/) constitute contrasting or phonemically distinct elements of the language’s sound structure.

It was precisely the claim of generative phonology, however, that phonological variation as part of the sound structure of a language does not stop at the point where potentially contrasting elements come to be involved. Generative phonology could thus assign variation such as that produced by the Turkish rules of Vowel Harmony and DeVoicing to the sound pattern of

* Note, for instance, that the morphemes in discontentedness cannot be combined in other orders, to yield e.g. *ness-ed-content-dis.
the language, rather than treating it as an idiosyncratic property of (each of) the morphemes subject to it. Once this program began to be explored, it quickly became obvious that it yielded a much more satisfactory account of the regularities of sound structure in natural language(s).

The consequence in this case for Turkish, however, is that there is no longer anything of note to be described as the "allomorphy" of the suffix \{-DIR\}: it simply has a basic phonological form, /-dir/, which is subject to the phonological rules of the language, including both Vowel Harmony and DeVoicing. Indeed, the general program of generative phonology was to reduce every morpheme to a single, unitary underlying form, and to characterize the variation in shape traditionally called allomorphy as due to the operation of the language's phonological regularities. Of course, this reduction cannot always be completely carried out: variation such as that among English be, am, are, is, was, were is surely not to be attributed to the operation of specific phonological rules. But insofar as such reduction is possible, it eliminates the study of allomorphy altogether; and apparently the cases in which reduction is excluded, like that of the English verb \{BE\}, are sufficiently circumscribed as to limit allomorphy to the uninteresting listing of lexically unsystematic or arbitrary forms. On this picture, there would be nothing of interest for a distinctly morphological discipline to study here.

What about the study of morphotactics? Here, too, generative grammar appeared to assimilate the subject matter of morphology to something else: in this case, to syntax. The great early success of generative grammar, indeed, lay precisely in the fact that it had a theory of syntax which was capable for the first time of providing a satisfying account of the principles by which syntactic units are assigned a structure. This theory, in its original form, had two components: a set of phrase-structure rules which assigned a basic constituent structure to sentences and their parts, and a set of transformations which manipulated this structure in various ways to yield a surface representation of the sentence.

Now one of the great public-relations successes in early generative syntax was the analysis of English auxiliary Verbs given in Chomsky 1957. Structuralist linguists had long wrestled with the apparently simple problem of describing the co-occurrence of auxiliary forms in English, without notable

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5 We use "I" here to indicate a vowel which is specified only as \ [+ High\], and for which there is no indication of backness or rounding, since these will be provided by rule. As is well known, there are many possible treatments of the phonological content underlying variation such as that encountered in Turkish vowel harmony, but the choice among these is not relevant to our concerns here. We adopt this alternative simply in order to give a concrete representation for the form under consideration.

6 Despite the valiant efforts of some early generative phonologists: see the attempt by Foley (1965) to derive the variants of the Latin copula sum by "regular" phonological rule.
The study of word structure

success. Chomsky proposed that these could be described as resulting from two factors: first, a phrase-structure rule generating each auxiliary element together with its associated required affix (if any); and second, a transformational rule (widely referred to as 'Affix Hopping') that puts each affix in its appropriate surface position. With some slight change of form, these can be represented in (4):

(4)  
\[ \text{Aux} \rightarrow \begin{cases} \text{Tense} \\ \text{Modal} \end{cases} (\text{have} + \text{en}) (\text{be} + \text{ing}) (\text{be} + \text{en}) \]

b. \[ \text{Af} + v \rightarrow v + Af \]
(where "Af" stands for any affix, and "v" stands for any Verb, have, or be)

This yields a derivation as indicated in (5) for a sentence such as John has been being seen in all the wrong places lately:

(5)  
\[ \text{John Pres have} + \text{en be} + \text{ing be} + \text{en see} \ldots \]
\[ \text{John has been being seen} \ldots \]

This simple and elegant analysis immediately resolves a large number of related problems involving English auxiliaries: and even if Syntactic Structures had made no other major points, this alone would probably have won a great many converts to generative grammar. What is important about this account for our purposes, though, is the fact that such an analysis implies that the elements which are manipulated by syntactic rules are not (necessarily) whole words, but rather individual morphemes. The possibility that both phrase-structure rules and transformations can manipulate morphemes directly naturally raises the question of whether any additional sorts of principles are necessary for word structure, in order to describe either the construction of Immediate Constituent structures such as figure 1.4 or the restrictions on morpheme combinations. The general view at the time was that no such additional principles (which would be specific to morphology) could possibly be justified, given the power of syntactic rules, and so morphotactics was taken to be just a (not particularly well-defined) subpart of syntax within the grammar of a natural language. There is a minor irony in this assimilation of morphotactics to syntax, since structuralist theory had assumed that morphological principles could be extended in the opposite direction to encompass syntax; but on either approach, the result was widespread agreement that morphotactics and syntax were substantively the same domain, whatever it might be called.
The position of early generative grammar with respect to word structure, then, was based on three general principles. First, the notion of the morpheme as a minimal sign, symbolizing a discrete subpart of a word's meaning by a discrete subpart of its form, was taken over essentially unchanged (indeed, unexamined) from structuralist theory. As on the prior view, this involved a general commitment to the principles in (3) above. Secondly, generative grammar assumed that whatever might be interesting about the principles governing the shapes of morphemes in a language would be encompassed in a description of its phonology, and thus that there was no need for a distinctively morphological study of allomorphy. Finally, and in a similar vein, it was assumed that the principles governing word-internal constituent structure and morpheme combination could be accommodated in a seamless way by the syntax, and thus that there was no need for a distinctively morphological study of morphotactics. Generative grammar thus ended up as a theory based centrally on the morpheme as a fundamental linguistic unit, but in such a way as not to require any particular theory of morphology.

In the chapters to come, it will be argued that in fact all of these moves were mistaken and should be rethought. In the following chapter, we will see that it is incorrect to attempt to reduce the principles of the internal structure of words to syntax, or to attempt to encompass all morphologically conditioned variation within a single homogeneous theory of phonology. In chapter 3, it will be argued that, indeed, the morpheme itself (at least, as classically construed) is not an appropriate element to serve as the foundation for a general theory of word structure in natural language. First, however, we must say a few words about words: the objects of inquiry in morphology.

1.2 The nature of words

There are a number of points of view from which words can be defined, as we discuss in more detail in chapter 8. One can attempt to characterize words as phonological units; as the irreducible terminal elements of syntactic structure; as the domain of principles regulating the appearance of morphological material; as the basic elements of the lexicon, and from a variety of other perspectives. In many (perhaps even most) cases, these various lines on what the word is converge on the same units; but unfortunately they do not always coincide, and this fact is responsible for a great deal of controversy. There is of course a massive traditional literature on the question of how to define the 'word,' and how to reconcile the various alternatives, but we make no attempt to do justice to this work here. In most examples in this book, the question of what constitutes a word in a specific case in a
particular language will not be a matter of controversy. There is one particular
sort of mismatch between criteria, however, which we must say something
about before proceeding with our more general investigation.

If we approach the definition of words from a phonological perspective,
we will identify as units those sequences of material that form single prosodic
constituents (at some level\footnote{There is a very considerable recent literature on the range of prosodic constituent types
that should be recognized in phonology and their relation to one another; see, for example, Nespor and Vogel 1986 for one view and a survey of the issues.}) in the full (metrical) phonological representation
of utterances. These constituents usually have some unitary property, such
as exactly one main stress, or certain sorts of internal sandhi that do not
apply across the boundaries between words, or indivisibility of production
(that is, the impossibility of pausing naturally within a single unit), or the
like. Sometimes, however, a single phonological word contains within it two
or more manifestly distinct syntactic items, all but one of which have been
reduced in form to the status of what we will call (following Zwicky 1977
and subsequent literature) simple clitics. These are elements belonging to some
syntactically well-defined type (e.g. Verb), appearing in a position where the
normal principles of the syntax might in principle sanction a member of
the relevant category. In an English sentence such as *How's your old man?*
the sequence [howz] (*how's*) is a single phonological word, though it contains
the two units *how* and *'s* (where the latter is a reduced, clitic form of the
verbal auxiliary *is*, appearing in the same position as the full form of the
auxiliary in the variant *How is your old man?*).

The Wakashan language *K*\textsuperscript{*}ak*\textsuperscript{*}ala provides a particularly dramatic
example of the phenomenon of simple cliticization. Consider the sentence in
(6):

(6) nanaq\=as\=il-ida i\=pg\=al\=wat-i \=aliwin\=ux\=a-s-is mestuwi
    guides-SBJ/ART expert-DEM hunter-INSTR-his harpoon
    la-\=xa mig\=at-i
    PRE-OBJ/ART seal-DEM

"An expert hunter guides the seal with his harpoon"

At first glance, it appears that *K*\textsuperscript{*}ak*\textsuperscript{*}ala inflection is distributed in a rather
strange fashion. The sentence-initial Verb, for example, ends in the element
-ida, which is a demonstrative referring to the deictic properties of a NP –
here, the Subject. This might, perhaps, be seen as a sort of agreement; but a
similar analysis seems highly implausible for the word aliwin\=ux\=a-s-is "hunter
(+ suffixes)," which ends in the elements -s-is "INSTR-his." It appears that this
word (the head of the Subject NP "expert hunter") is actually inflected for
the case and possessor of the following NP, "(with his) harpoon." In fact,
when we examine Kwak'ala sentences in general, we find that this is quite systematic: the inflectional markers for case, deictic status, and possessor of every NP are found not within that NP itself but rather on the preceding element of the sentence – whatever that may be, and regardless of its grammatical relation to the NP in question.

The spaces in examples like (6) above delimit phonological words; without going into details here, the integrity of these stretches in Kwak'ala prosodic structure is clear. Nonetheless, phonological words like *sliwine*a-s-is “hunter-INSTR-his” are equally clearly composed, from the point of view of the syntax, of two quite disparate elements: a Noun, head of its own NP, and a Determiner element belonging not to that NP but to the following one. In fact, from a formal point of view, Kwak'ala Determiners are composed of two parts: one of these (marking case, deictic status, and possessor [if the NP is possessed]) comes at the beginning of the NP, and the second (marking deixis and possessor in a partially redundant fashion) comes after the first word of the NP. The element -i at the end of *ipgel'wat-i “expert-dem.” is an instance of such a “second Determiner,” but since the most common NP categories in Kwak’ala involve phonologically null second Determiners, we will, in general, ignore these items in the examples to follow.

What is important to observe is the following: while the first component of the Determiner, a constituent which appears with every NP, comes at the left margin of the NP in linear order, it forms a phonological constituent not with some other part of that NP but rather with what precedes. We could schematize this situation as in figure 1.5, in which two structures are simultaneously imposed on the same string of elements. One of these is the syntactic structure of the sentence (shown here below the phonological string), and the other is a phonological organization into words (shown above the string).

It is clear that if the morphology of Kwak’ala is responsible for characterizing the internal form of phonological words, it will have to overlap heavily with the syntax in order to describe such facts. An alternative, however, is to suggest that the phonological word is not actually the domain of morphological principles of word structure. It is not, in fact, difficult to motivate an alternative in Kwak’ala, since other principles of the language converge on a unit somewhat different from the phonological word as the one to which syntactic processes (such as movements or word-order

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* Since Kwak’ala is a Verb-initial language with no possibility of preposing NPs to the position preceding the Verb, every NP is always guaranteed to have some phonological material to its left.

* Actually, phonological words are only one level of the prosodic structure of sentences, others being the syllable, the foot, and the phonological phrase. Since it is only the level of words that interests us here, the full prosodic organization of the utterance is not shown.
20  The study of word structure

permutations) apply. Basically, the 'grammatical words' in this sense are composed of stems together with all of their applicable derivational material, but excluding the Determiner clitics (which constitute grammatical words in their own right, though never autonomous phonological words). We will argue in chapter 8 that the only unusual property of simple clitics such as the K'ak'al Determiners is a phonological one: unlike other lexical items, clitics do not constitute prosodically autonomous words, and must be incorporated into some other word in order to be realized phonetically. Otherwise, however, their positioning is described by (at least a subset of) the regularities of the syntax not specific to clitics.

In this regard, clitics like the K'ak'al Determiners differ from a second class of items, the **special clitics** (again following terminology established by Zwicky [1977]). The distinguishing characteristic of these forms is the requirement that they appear in some special, designated position where no rule normally applicable to items of their lexical class would locate them. The best-known class of such special clitics is the set of **second-position** clitics that

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**Figure 1.5** Phonological and syntactic organization of a K'ak'al sentence

- V: Verb
- Adj: Adjective
- N: Noun
- P: Preposition
- Dem: Demonstrative
- Art: Article
- Suff: Suffix
- Mod: Modifier
- Case: Case Marker
- NP: Noun Phrase
- PP: Prepositional Phrase
- S: Sentence

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nanaqasil-ida
i?gal'wat-i
alewinux*a-s-is
mestuw-i
la-xa
mig*at-i
```
appear in many languages. Like simple clitics, these special clitics are (usually) prosodically deficient and thus phonologically dependent on an adjacent word (the property responsible for characterizing a general class of clitics), but some other rule must be responsible for their surface position. *K*alala, in addition to its simple Determiner clitics, also displays a set of second-position clitic elements marking the person and number of a Subject NP. The examples in (7) below illustrate this behavior in subordinate clauses, where the clitic immediately follows the clause-initial complementizer element -x (which is itself a simple clitic, phonologically dependent on the matrix-clause element to its left). Subordinate clauses are more interesting in this connection than main clauses, since the Subject clitic material’s second position puts it before the main Verb, a place where Subject NPs themselves can never be found (as shown by example (7c) below):

(7) a. -x-gen t'uxa-ik
   for-I marked = trail-DEM
   "for/that I marked the trail"

b. -x-s t'uxa-ida 'wats'i
   for-3 marked = trail-ART dog
   "for/that the dog marked the trail"

c. -x-(s)-ida 'wats'i t'uxa
   for-(3)-ART dog marked = trail
   ("for/that the dog marked the trail")

We will return to the question of special clitics and their sources in chapter 8. For present purposes, we assume that the phenomena represented by clitics of both types can be isolated and given a coherent account, so that we can focus on the extent to which other word-internal elements are of concern to the syntax of a language.

Apart from the issue of how to treat clitics, there are many other problems that would need to be solved before we could claim to have a full theory of what ‘words’ are. On the assumption that the various alternative approaches have differing consequences only in rather marginal cases, however, we can proceed as if we knew how to delimit words, as indeed we generally do. On this basis, it is clear that many words are internally complex in ways such as those suggested earlier in this chapter, and therefore that there is something of interest to study about the principles of their formation. We thus go on in the next chapter to discuss the evidence for distinguishing principles of morphology from those of syntax, on the one hand, and those of phonology, on the other.
2 Why have a morphology at all?

This chapter is devoted to the question raised above of whether it makes theoretical sense to distinguish principles of morphology from those of other parts of a grammar. In section 2.1 we will look more closely at the system of a single language, Kwak'ala, in which the grammar of words is particularly well developed. Among its many interesting features, Kwak'ala allows us to examine the relation between morphology and syntax in some detail, because the language displays at the same time a rich and highly structured syntax, and an equally developed and highly structured system of word formation. When we look closely at the facts in these two domains, we will see that they are governed by rather different principles. The point of such a demonstration in the present context is to show that two quite separate rule systems govern Kwak'ala 'grammar' (in the generalized sense of 'morphosyntax'), and that the line between them corresponds to the difference between principles operating within a word and those organizing words into higher-level units.

Following this demonstration that an individual language may distinguish the grammar of words from the syntax of phrases, we consider the issue in more general terms. If we take seriously the suggestion that a system of principles governs the construction of words and their relations within a lexicon, and a different system governs the syntactic structure of phrases, clauses, etc., we would expect some systematic differences to obtain between the two systems. In section 2.2 we explore the predictions of this position for the distinction between morphology and syntax as overall theoretical problems, in contrast to the language-specific distinction evidenced by the considerations of section 2.1. A similar contrast is explored in section 2.3, this time between principles of word structure governing the overt phonological form of elements in terms of the morphological composition of the words in which they appear and principles of sound structure (or phonology) sensu stricto. As in the case of morphology and syntax, and despite some apparent overlap, we conclude that there are potentially important differences between morphology and phonology. Together, these conclusions establish the need to develop a theory of morphology on its own terms, though
they do not, of course, in themselves determine what the form of such a theory might be. The remainder of this work is devoted to questions of this latter sort.

2.1 Morphology and syntax in K'ak'wa'la

There is at least one view in the recent literature that proposes to treat the organization of morphological units by a single homogeneous set of (syntactic) rules, regardless of whether significant relations occur within or across the boundaries of words. This is the early formulation of a theory of 'Autolexical Syntax' as represented by Sadock 1985. According to the view taken in that paper,¹ the minimal elements which terminate syntactic structures are generally morphemes,² not words. The organization of a (syntactically structured) sentence into words is a completely independent bracketing of its component morphemes, parallel to (but not directly constrained by) their organization into syntactic constituents.

The consequence of such a view is to open the way to a syntactic account of phenomena that might otherwise be taken to be matters of word structure. Principal among these is the apparent combination of a Noun with a Verb of which it is an argument within a single word. If one takes words to be the minimal unit manipulated by the rules of syntax, it is necessary to assign rather different structures to closely similar sentence types with and without such 'incorporation.' On Sadock's view, in contrast, a uniform syntactic structure can be assigned to both, with the only difference (the grouping of morphemes into surface words) treated as syntactically irrelevant. As an example, the Eskimo sentence in (1) can be assigned two parallel structures, as indicated in figure 2.1. The structure in example (1) is an organization of the linguistic material into surface words, and that in figure 2.1 is a syntactic organization.

¹ Sadock's position on these issues has evolved considerably since the publication of his earlier work, and the objections raised below do not apply directly to his current views as expressed, for example, in Sadock 1991. The correct interpretation of an individual's work is, of course, an important matter for scholarship, but our present concern is with the overall question of whether the relative organization of proper subparts of words ought to be governed by principles of the syntax sensu stricto. This latter issue is the focus of the discussion below, for which Sadock's initial formulations simply serve as a conveniently explicit starting point.

² The internal relations of a group of morphemes may sometimes be syntactically irrelevant: in that case, they are taken to be a unit from the syntactic point of view. Nonetheless, in general, Sadock's syntactic representations organize morphemes into syntactic constituents in a way quite independent of the grouping of those same morphemes into words.
Why have a morphology at all?

(1) hansi ataatsinik qamuteqarpoq
"Hansi has a sled"

![Diagram of an Eskimo sentence]

What is important to note about this line of analysis is that it treats morphological and syntactic form as two distinct, independent bracketings of the same surface string of morphemes. In essence, a single set of syntactic operations is responsible for describing the relative placement of morpheme-sized elements, and their inter-relations. On the resulting string of these basic formatives, two sorts of structure are independently imposed: one an organization into words, and the other a completely separate and, in principle, unrelated organization into syntactically functional constituents. Of course, in many languages the two analyses may converge so as to treat similar (or at least highly congruent) substrings of the overall structure as unitary constituents, but such a connection is not logically necessary.

The distinguishing features of this position are: (a) it treats the relative positioning of intra-word elements as performed by the rules of the syntax; and (b) it therefore treats morphemes, rather than words, as the internally unanalyzed primitive elements of sentence structure. Sadock argues that this is particularly appealing in dealing with such constructions as the one usually referred to as 'Noun incorporation'; a related position with much the same properties (though based on rather different underlying assumptions about the syntax) is developed by Baker (1987). These constructions present a number of unusual and distinctive features, and will be the subject of some discussion in chapter 10 and elsewhere below. At this point, however, rather than addressing the issue of whether an analysis along these lines is applicable to
Eskimo, we concentrate on the question of whether it generalizes in the way we would expect if the operations of syntax do in fact manipulate morphemes, where word structure is an ancillary, independent organization imposed on strings composed of these units.

In a language like Eskimo, it is particularly difficult to disentangle issues of word structure from those of sentence structure. The fact is that the individual components of a complex word in such a 'polysynthetic' language are easy to isolate, and many of them correspond rather directly to elements that can appear independently as syntactically autonomous words. Combine this with the extreme flexibility of word order in the language (the syntax per se puts very few constraints on the linear placement of elements), and it is not surprising that the syntax can generally provide the sequence which the morphology appears to require. Of course, it does not follow from this that the syntax must actually have been what was at work below the level of the word, but on the other hand, the flexibility of positioning which Eskimo syntax allows makes it difficult to construct an argument either for or against this position from the facts of word structure per se.

The strategy here, then, will be to examine a different language, K'akw'ala, whose morphology has a degree of complexity and expressive power roughly comparable to that of Eskimo, but whose syntax constrains the order of elements much more tightly. If the syntactically based analysis of word-internal elements suggested above could be extended to this language as well, this result would constitute a strong argument for the sufficiency of syntactic rules in governing the placement of linguistic primes within larger structures. We will see, however, that the morphology and the syntax of K'akw'ala make rather different and sometimes incompatible demands concerning the order of elements. The generalization that emerges for this language is that when two elements form part of the same word, it is the morphological system that accounts for their inter-relations; but that when distinct words are involved, their relative positioning is governed by the syntax. This suggests that morphology and syntax are indeed two distinct systems, controlling the internal structure of words and of phrases respectively. Of course, if this result is motivated for K'akw'ala, it might well be interesting to re-examine the case of a language like Eskimo to see if a similar conclusion might be valid for it as well; but the general point will be established insofar as we can demonstrate that in at least some languages the morphological and the syntactic rules constitute distinct systems of grammar that operate within different domains.

Table 2.1 illustrates some of the expressive power of K'akw'ala affixation. This small selection from the vast set of suffixes found in the language\(^3\) is

\(^3\) See Boas 1947 for more extensive discussion of the scope of the K'akw'ala suffix system.
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Table 2.1 Some K'ak'w'ala 'lexical suffixes'

<table>
<thead>
<tr>
<th>#</th>
<th>Base</th>
<th>Suffix</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>naqa</td>
<td>&quot;drink&quot;</td>
<td>&quot;drink&quot;</td>
</tr>
<tr>
<td></td>
<td>mig'at</td>
<td>&quot;seal&quot;</td>
<td>&quot;to obtain seals&quot;</td>
</tr>
<tr>
<td></td>
<td>r'ik-</td>
<td>&quot;good&quot;</td>
<td>&quot;smells sweet&quot;</td>
</tr>
<tr>
<td></td>
<td>q'ay-</td>
<td>&quot;many&quot;</td>
<td>&quot;many walk&quot;</td>
</tr>
<tr>
<td>2</td>
<td>naq'a</td>
<td>&quot;cover with blanket&quot;</td>
<td>&quot;cover cheek with blanket&quot;</td>
</tr>
<tr>
<td></td>
<td>mig'at</td>
<td>&quot;seal&quot;</td>
<td>&quot;stone-tooth&quot;</td>
</tr>
<tr>
<td></td>
<td>gakt-</td>
<td>&quot;long&quot;</td>
<td>&quot;long-eared&quot;</td>
</tr>
<tr>
<td></td>
<td>q'ay-</td>
<td>&quot;many&quot;</td>
<td>&quot;place of many&quot;</td>
</tr>
<tr>
<td>3</td>
<td>danx'ala</td>
<td>&quot;sing&quot;</td>
<td>&quot;sing nicely&quot;</td>
</tr>
<tr>
<td></td>
<td>q'aku</td>
<td>&quot;slave&quot;</td>
<td>&quot;small slave&quot;</td>
</tr>
<tr>
<td></td>
<td>'yak</td>
<td>&quot;bad&quot;</td>
<td>&quot;altogether bad&quot;</td>
</tr>
<tr>
<td></td>
<td>q'ay-</td>
<td>&quot;many&quot;</td>
<td>&quot;too many&quot;</td>
</tr>
<tr>
<td>4</td>
<td>muk'a</td>
<td>&quot;to tie&quot;</td>
<td>&quot;to tie in the middle&quot;</td>
</tr>
<tr>
<td></td>
<td>giaq-</td>
<td>&quot;chief&quot;</td>
<td>&quot;chief under others&quot;</td>
</tr>
<tr>
<td></td>
<td>'mala</td>
<td>&quot;white&quot;</td>
<td>&quot;white on surface&quot;</td>
</tr>
<tr>
<td></td>
<td>q'ay-</td>
<td>&quot;many&quot;</td>
<td>&quot;many in a canoe&quot;</td>
</tr>
</tbody>
</table>

organized as follows. The four parts of the table illustrate suffixes that correspond to Verbs, to Nouns, to Adjectives and/or Adverbs, and to locational PPs, respectively. Within each set, an example is given of the attachment of such a suffix to a base that is a member of the class of Verbs, Nouns, Adjectives, and Quantifiers, respectively. The purpose of this is to illustrate the following facts: (a) the expressive scope of suffixes overlaps with all of the major word classes in the language; and (b) suffixes with any of these properties may attach to bases belonging to essentially any syntactic category. The suffixes themselves, then, have much of the substantive and combining properties of syntactically free elements; and it is precisely the capacity to utilize such elements to form surface 'words' with a high degree of internal structure of a quasi-syntactic sort that makes a language like K'ak'w'ala (or Eskimo) 'polysynthetic.'

Since the properties of affixes in K'ak'w'ala resemble those of syntactically free elements in their substantive aspects, it would be reasonable to expect that an analysis similar to that entertained for Eskimo above, where word-internal elements are manipulated by syntactic rule, would apply in this language as well. What we actually find, however, cannot be reconciled with this proposal. In K'ak'w'ala, unlike Eskimo, the order of elements as determined by the syntax is relatively inflexible. Furthermore, the requirements of the principles of phrasal syntax in this language are directly contradicted by the requirements of the word-internal organization of morphological units.
This should be impossible if the structure of words is determined by the principles of the syntax.

We can examine this issue in concrete terms by looking at the grammar of K\textsuperscript{w}ak\textsuperscript{w}ala for structural properties that are apparently invariable at the phrasal level,\textsuperscript{4} and then looking to see if the same properties are replicated at the level of constituents within the word. Insofar as the principles at work within the domain of the word turn out to be distinct from those applying within larger, phrasal domains, we have support for the notion that morphology (in particular, morphotactics) is distinct from (phrasal) syntax. This constitutes a strong argument against a position that would have individual morphemes positioned and manipulated by a single set of syntactic rules independent of their organization into the words of which they are constituents.

A number of properties of the order of constituents in K\textsuperscript{w}ak\textsuperscript{w}ala sentences furnish arguments of the sort just proposed. For example, the relative order of the main constituents of a clause is quite rigid. The Verb appears in initial position, followed by the Subject NP, which is in turn followed by complements such as (either of two formally distinct types of) Objects and Prepositional Phrases. In some clauses, more than one Verb can appear, and when this is true, the Subject NP can come either (a) after all of the Verbs; or (b) after the first Verb, but before the others. There is no possibility, however, for any NP except the Subject to precede any Verb, or for the Subject NP to precede the initial Verb. We emphasize that these orderings constitute quite general rules of the syntax of K\textsuperscript{w}ak\textsuperscript{w}ala, and not simply preferences or statistical regularities.

At the word level, however, these generalizations do not hold. Within the word, an element representing the 'Object' of another element bearing the content of a Verb can perfectly well precede it, when the construction is formed by attaching a verbalizing suffix to a nominal stem as in example (2):

(2) \([v_k \chi'ina-] \text{gila}]\) \([v_k \text{oil}] \text{make}\)

"to make (fish) oil"

If the surface word in this example is simply the phonological bracketing of elements positioned by rules of the syntax, it is hard to account for the

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\textsuperscript{4} See Anderson 1984a and references given there for a discussion of the basic syntactic principles of K\textsuperscript{w}ak\textsuperscript{w}ala. The analyses given there are assumed below without explicit argument. While there are certainly points in the rich syntax of this language that are not entirely clear, the matters at issue in the present discussion are quite straightforward, and the evidence supporting our assertions about K\textsuperscript{w}ak\textsuperscript{w}ala phrasal structure is not repeated here.
position of the 'Object' before its 'Verb,' given the fact that this order is syntactically ill formed.

Similarly, Subject NPs in K*ak"ala sentences systematically precede Object NPs when both are present. This order is inflexible when distinct phrases are involved. When the 'Object' argument is a subconstituent of the Verb, however, it can precede the Subject of the same Verb, as in example (3):

(3) \[v\{v na'w-[am'y-]\{NP\{Det ida\} \{N b\og ananem\}\}\} [v\{v cover-\} cheek\{NP\{Det the\} \{N man\}\}]\]

"The man covers his cheek (with a blanket)"

Again, since the syntax forbids the positioning of the Object NP "cheek" before the Subject NP "the man," it is difficult to avoid the conclusion that the formation of na'wam'ya 'covers cheek' involves principles other than those of the phrasal syntax.

The general form of such arguments should now be clear, and we give only two more (out of a number that could be constructed). For instance, modifying Adjectives precede their heads within phrases, but within a word, it is possible to suffix 'adjectival' material to a nominal stem whose content it modifies, as in example (4):

(4) \[N [N \{n\{a\}aq\{a-\}] dzi\] \[N [N \{n\{opper\} large\}]\]

"a large copper (a ceremonial object)"

A final argument of this general type concerns the possibilities for verbal complements in sentences with more than one Verb. When more than one Verb occurs in a clause, only the last of them can take complements (Objects, PPs, etc.). The non-final Verbs must all be structurally intransitive, conveying essentially adverbial modifications of the meaning of the final Verb as in the examples in (5):

(5) a. lam'-sn Pit'id\=a-\ldots aml\=ida-t\=sa k\=agul\=ix

AUX-I again-FUT ridicule-FUT-INSTR K\=agul-DEM

"I will again make fun of the K\=agul"

b. la-\=\ldots ax\=wala\ldots dala-\ldots is\ldots nabayu

AUX-PRO rise in boat hold-OBJ-his warclub

"He arose in the boat holding his warclub"

This restriction is interestingly similar to a limitation on English Verb-Verb compounds noted by Lieber (1983a). If this similarity is taken to motivate an analysis of such verbal sequences in K*ak"ala as compounds, the fact that they can be interrupted by the Subject NP would seem to support the contention, in chapter 11 below, that compounds (as opposed to most affixed forms) are the primary class of morphologically complex formations that have an internal structure potentially visible to other rules, including those of the syntax.
2.1 Morphology and syntax in K'ak'w'ala

When suffixes with verbal content are added to verbal stems within a single word, however, the restriction against non-final Verbs taking complements does not hold. Quite typically, in fact, it is the (initial) stem whose complement structure is most extensively articulated, as in example (6):

(6) \[v \ [v \text{han}^\text{a-}] \text{but-}] [\text{NP \ [Det \ ida] \ [N \text{bog}^\text{anoma-}]}) [\text{NP \ [Det \ xa]} \ [v \ [v \text{ shoot} \text{pretend}] [\text{NP \ [Det \ the]} \ [\text{man}]] [\text{NP \ [Det \ the]} \ [\text{N \text{Giwas}] \ [\text{N \text{deer}]}}

"The man is pretending to shoot the deer"

The conclusion that must be drawn from all of these cases is the following. Although both independent words and word-internal affixes can carry the content of all major word classes (Verbs, Nouns, Adjectives, etc.), quite different principles apply to determine the relative positioning of words within phrases (and clauses) on the one hand, and stems and affixes within words on the other. Though we have not provided a set of rules for word-internal structure as yet, the arguments above (which could be multiplied virtually \textit{ad libitum}) clearly establish the distinctness of such rules from those of the phrasal syntax. Rules of morphology (specifically morphotactics) are distinct from rules of syntax.

Arguments in the recent literature in support of the claim that syntactic processes can manipulate proper subparts of words, such as those presented in Sadock 1985 and more recently Baker 1987, have focused on 'Noun-incorporation' constructions. Such formations, which occur in many languages, have the property that part or all of some verbal complement (typically the Direct Object) is represented not by an independent word, but rather by a subpart of the word containing the Verb. The very name of this construction suggests an analysis on which the complement in question is generated as a separate argument position, and part or all of it is (subsequently or simultaneously) 'incorporated' into a unit with the Verb. K'ak'w'ala displays Noun incorporation abundantly, and it is therefore possible to examine the details of the construction here to see how much support it offers for theories that place proper subparts of words in their surface positions by syntactic means.

While the 'incorporation' analysis has some initial attractiveness, there are some rather severe difficulties that arise for it in K'ak'w'ala. An immediate problem is the fact that, even when some Noun has apparently been 'incorporated' into the Verb, it may also appear as an independent word in the sentence.\footnote{This point has also been made in Mithun 1984, especially with respect to the 'incorporation' constructions of languages of the Iroquoian family.} Phrases illustrative of this phenomenon are given in (7) below.
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In all of these cases, the Noun representing an argument of the attached verbalizing suffix is the same as that which serves as the head of an overt Object NP.

(7) a. luqʷ-iluxʷ-a-ča luqʷ-i? dish-make-expert-OBJ dish-NOMINAL “the dishmaker (of dishes)”
   b. ts'ixe-ča ts'ixe-iná (pick) elderberries-OBJ (pick) elderberries-NOMINAL “to pick elderberries”
   c. q'omdzakʷ-iluxsd-ida bágʷanoma-ča q'omdzakʷi? salmonberry-give feast-want-DET man-OBJ salmonberries “[when] the man wants to give a salmonberry feast (of salmonberries)”

A similar phenomenon can be found in connection with Prepositional Phrases whose content is primarily locative. Examples such as those in (8) below illustrate locative suffixes; one might claim that these elements represent ‘incorporated’ PPs.

(8) a. k'i-ts'ol-ís la-č-i s k'at'aaSí spit-into-he-it PREP-OBJ-his paintdish “He spits it (into it) into his paintdish”
   b. la-i ax-dzu-x*ts'and-as la-č-is helk'ut's'ana'iyí AUX-she put-on flat-on hand-it PREP-OBJ-her palm of right hand “She puts it (on a flat thing, her hand) on the palm of her right hand”
   c. la-i dzadzak-amt-s la-č-is guGʷ'anoma'iyí AUX-she rubs (DISTRIB)-face-it PREP-OBJ-her face “She rubs it (all over on face) on her face”

Here again, however, the fact that the supposedly ‘incorporated’ material (“into it,” “on the flat of her hand,” “on her face”) is still present in syntactically autonomous form presents a problem. Actually, in the case of locative expressions, this problem is in some ways worse than with Direct Object NPs. The inventory of lexical prepositions in Kʷalákʷala is extremely limited. Ignoring the benefactive element qa, whose syntactic status is not entirely clear, there is essentially only one Preposition in the language: la. While this element fills the syntactic role of a Preposition, its semantic content is essentially nil: a phrase like lax k'amašísa-(sis) in the examples in (9) below can, by itself (and ignoring the following clitic), mean any of “on the beach,” “from the beach,” “down to the beach,” etc.

This element is itself homophonous with the Verb la “go.” Further, it has an irregular suppletive form gax used with first-person Objects – and this form is itself homophonous with the Verb gax “come.” In the language as attested today and in recorded texts, there is no reason to doubt the status of this element la/gax as a syntactic Preposition, but the facts just noted suggest that the reanalysis of some sort of serial-Verb construction is its diachronic source.
2.1 Morphology and syntax in K’ak’w’ala

(9) a. gal’mis-i laga-lis la-χ ƛ’amāʔisa-s-is gukʷi
first-she arrive-on beach PREP-OBJ beach-of-her house
“as soon as she arrives on the beach of her house”
b. qaʔs 1-e huqʷ-ənts’is laχ ƛ’amāʔisa-s-is
then AUX-they go[PL]-down to beach PREP-OBJ beach-of-their
houses then AUX-they go[PL]-in canoe-cont PREP-OBJ-their
hihamy-ats’i-ʔa-χa q’əmdzakʷi xʷaχʷagʷəma
berry picking-receptacle-FUT-OBJ salmonberries little canoes
“Then they go down to the beaches of their houses, and get into the
little canoes they use to pick salmonberries”

In such cases, the only way to understand the locative content of the PP
is by reference to the Verb-internal suffix. The suffix -lis in example (9a)
describes the associated action (“arrives”) as taking place “on a beach,”
-ents’is in example (9b) describes “(they) go” as taking place “down to a
beach,” etc. Now, if we were to describe the suffixes as representing
incorporated locative expressions, we would face two closely related problems.
First of all, the ‘incorporation’ in such cases is obligatory, as opposed to most
incorporation constructions, where an unincorporated variant is (at least
syntactically) possible. Secondly, however, there is no evidence at all for the
lexical existence of the supposedly incorporated material. It only appears as
a part of an internally complex word, to whose total meaning it makes a
determinate contribution. The ‘incorporated’ elements of such structures thus
do not at all display the properties of syntactically manipulable, freely
occurring items. The classes of word-internal locative suffixes and locative
PPs are not in complementary distribution (as one would expect if movement
of the latter were the source of the former). Rather, they occur together as a
matter of necessity. This requirement is strictly a semantic one, however. As
far as the syntax is concerned, a Verb with ‘incorporated’ elements has exactly
the same properties as one that is basic.

From the examples of supposed ‘incorporation’ in K’ak’w’ala that have
been given in examples (7)–(9) above, we see that a syntactic movement
analysis of incorporation in this language faces a very serious problem. The
supposedly incorporated material, or at least significant parts of it, remains
in situ even after it has been incorporated. To deal with this difficulty, we
might propose an alternative account that involves generating semantically
similar material in two independent structural positions: within a syntactic
argument, and also within a complex lexical stem governing that argument.
Before proposing such an account, however, let us examine some cases that
are quite similar to examples that have been cited in the literature.

In the examples in (10), only the head of a complement appears to have
been ‘incorporated’:
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(10) a. gal ts'ix?it-sa'w-ida bōnaabo'ya-s
first pick elderberries-PASSIVE-ART growing down below-her(s)
"(first) she picks those of her elderberries growing at the bottom"
b. hexhax?id-xa خذbulak"i
eat salmon heads-OBJ roasted
"to eat roasted salmon-heads"

Such constructions, in which a part of a phrase remains in the syntactically expected position for the argument it represents while its head appears 'incorporated' into a governing Verb, has sometimes been cited (e.g. by Sadock [1980]) as evidence for a movement analysis of such constructions. The movement of the head of the Object NP in such examples would provide an explanation for the appearance of otherwise anomalous headless phrases in surface structures.

In the present case, however, there is another account that is readily available, one that does not entail any sort of 'incorporation' to derive (10) and related sentences. The property of the NPs in (10) that suggests an incorporation analysis is their lack of an apparent head; but in fact NPs in Kwak'alala may well lack a phonologically realized head even when no 'incorporation' can possibly have taken place. The sentences in (11) involve NPs whose heads must be analyzed as a phonologically null pronominal element:

(11) a. l-e 'ya'yaxsa bəg′anam-i
Aux-they bad(PL) male-DEM
"The male (sea-eggs) are bad"
b. duq′ala-su-sa ts′adaqa awaw-i
seek-PASSIVE-by ART woman big-DEM
"The big (ones) are sought by the woman"

Given the possibility that NPs may consist of a phonologically null pronominal head together with associated modifiers, we can readily provide an analysis for constructions in which the governing Verb contains material specifying some of the semantic properties of the referent of the same argument.

The analysis we have in mind remains to be developed in detail, but in outline, it is as follows. Let us assume that Verbs which apparently involve an 'incorporated' Object Noun are formed by a process of derivational morphology according to which a verbalizing suffix is added to a nominal base within the lexicon. The suffix in question is characterized as producing

* The analysis proposed here is parallel to the account proposed for 'Classifier'-type Noun incorporation in Rosen 1989. See that work for more detailed suggestions concerning the formal mechanisms involved in describing this construction within a framework similar in essential details to that assumed here.
2.1 Morphology and syntax in *Kawalala*

Verbs with a particular subcategorization frame – typically that of transitive Verbs. The derivational rule in question specifies that this suffix can be added to nominal stems, and, furthermore, that in the semantic representation of the resulting transitive Verb, the semantic properties of the base Noun are incorporated as specifications (akin to co-occurrence restrictions in an earlier terminology) that impose restrictions on the derived Verb’s Object.

The process deriving *hexhaxpid* “eat salmon-heads” from the base *hex-“salmon-head”* thus takes Noun stems with semantic interpretation “COMMON-NOUN” into transitive Verbs meaning “EAT ["COMMON-NOUN"]\text{NP}” or the like. The essence of this structure is the fact that the semantic features of the base nominal specify some of the properties of the Object argument, but without eliminating that argument position syntactically. In a language of this type, the correct interpretation for sentences like those in (10) is derived by simply unifying the semantic properties of the Object argument that are specified by that NP (e.g. in example (10b), the material “ROASTED [ones]”) with the semantic material already attached to that argument as the result of the derivation (in this case, the material “SALMON-HEADS”). Such an account extends quite naturally to the cases of incorporated locatives that further specify the content of PPs, discussed above.

If something like the suggestion just made can be maintained, there is no longer any need to treat ‘incorporated’ Object Noun stems or other elements as having undergone movement in the syntax. Instead, they are composed with a verbalizing suffix (or else, as in the case of locatives, they are themselves added as suffixes to another stem) by rules of derivational morphology. These rules create new stems that are internally complex in morphological and semantic terms. The resulting stems may govern syntactic argument positions (such as Object NPs, PPs, etc.). Such governed complements may contain varying amounts of lexical material, ranging from full complexes of lexical items (insofar as the stem itself does not specify any of the semantics of the complement) through partial specification (as in the examples in (10) or those involving locatives [(8), (9)], where the character of the “prepositional” relationship, and perhaps some properties of the Object, are specified by the suffix and the remainder of the properties of the Object by the NP Object of the semantically empty Preposition *la/gax-* to redundant specification (as in

* It is apparently a language-particular fact about *Kawalala* that it allows such argument specification without elimination of the specified argument. Other languages, in which ‘incorporated’ and ‘unincorporated’ arguments are mutually exclusive are to be described as only allowing such specification in association with the removal of an argument position in an operation of detransitivization or the like. The distinction corresponds to the difference between “Classifier” and “Compound” types of Noun incorporation as described by Rosen (1989).
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examples like (7)) and ultimately to a mere phonetically null proform that serves simply as a syntactic place holder.

There is a further reason to prefer the "independent generation" account offered above to the "syntactic incorporation" account of the constructions we have been considering. Writers proposing syntactic movement as the mechanism of incorporation have generally argued that only heads of phrases, and not subordinate elements, can undergo such movement. Baker (1987: 53ff.) claims to derive this result as a theorem (the 'Head Movement Constraint') from the principles of the syntax, for example. But in K*ak*w'ala, at least, this limitation is not observed, and some constructions appear to involve the 'incorporation' of a modifier while the head of its phrase remains in situ:

(12) a. la-i hoq*w'wals-ida q'isq'asde-xa k*əlx-i q'isina
  "Those who have been eating the raw currants go out"

b. la-i k*əlxk'ax-suʔ-əm-χát'-ida q'isina
  "Raw currants are also eaten"

c. k*əlxk'axa-ʔaxa-ida bakʷ*oma-xa t'əmχʷ*ali
  "The Indians also eat raw gooseberries"

In order to accommodate examples such as these within a movement analysis, it would apparently be necessary to do some violence to principles of syntax that otherwise seem well established (at least to the extent one accepts Baker's argument referred to above). This provides further support for a non-syntactic analysis of "incorporation" in K*ak*w'ala.

Assuming an "independent generation" account as outlined above, an interesting generalization emerges from a comparison of those items that are generated as internal parts of words (the set of lexical stems and suffixes) with those that are generated as syntactic constituents. Essentially, this is the following: no matter how complex the internal composition of a word, the syntactic frames within which it occurs are exactly those that simple, underived words can appear in. In contrast, the 'frames' that word-internal morphological elements can occur in violate virtually all of the generalizations that one would derive from the syntax of underived words.10 This strongly suggests that the internal composition of words in K*ak*w'ala is determined by a different set of principles from those that govern phrasal syntax. Of course, we might call these principles 'internal syntax' (as in the usage of Swadesh 1939, for example), but this does not alter the fact that there is little

10 Recall the facts of examples such as (2)-(6), for instance.
if any overlap between the principles of this 'internal syntax' and those of 'syntax' tout court.\textsuperscript{11}

In fact, the principles of K\textsuperscript{ak}\textsuperscript{\textasciitilde}ala derivational morphology appear to differ from those of the syntax not only in their substantive content but even in the primitives to which they refer. In Anderson 1977a it was suggested that lexical rules (i.e. those operating to create complex words out of morphological material) differ from syntactic rules in referring to specific, substantively characterized $\theta$-roles where syntactic rules can refer only to grammatical relations. Evidence for this is provided by rules such as that suffixing \textit{-ima} to Verb stems to create new predicates comparable to English Adjectives in \textit{-able}:

\begin{enumerate}
\item a. bibax\textit{\textsuperscript{\texttilde}ima} “cuttable” (cf. bax- “cut”)
\item b. titap’\textit{\textsuperscript{\texttilde}ima} “breakable” (cf. top- “break”)
\item c. ninax’\textit{\textsuperscript{\texttilde}wana\textsuperscript{\texttilde}ima} “able to be used as a blanket” (cf. nax\textsuperscript{\textast} “blanket”)
\item d. xixak’\textit{\textsuperscript{\texttilde}anga\textsuperscript{\texttilde}ima} “liable to stay away (for good)” (cf. xak’a “stay away”)
\item e. hi’\textit{\textsuperscript{\texttilde}anga\textsuperscript{\texttilde}ima} “liable to hesitate” (cf. hala “return, hesitate”)
\item f. manmnax’\textit{\textsuperscript{\texttilde}ima} “liable to smile” (cf. manx\textsuperscript{\textast}ala “smile”)
\item g. qaqa’\textit{\textsuperscript{\texttilde}ima} “(become) able to walk” (cf. qasa “walk”)
\end{enumerate}

Like English \textit{-able} (see chapter 7 below), this suffix can be added to transitive Verbs (either simple, as in (13a), (13b), or derived, as (13c)). When added to such a transitive stem, the suffix clearly picks out the OBJECT/PATIENT argument in yielding a new predicate “\textit{VERB-able}.” Unlike the English suffix, however, K\textsuperscript{ak}\textsuperscript{\textasciitilde}ala \textit{-ima} can be added to a range of syntactically intransitive Verbs, including both those that might be treated as underlying unaccusative (as in (13d), (13e)) on a syntactic analysis where some superficial intransitives have their single argument in underlying Object (rather than Subject) position\textsuperscript{12} and those that all analysts treat as taking their single argument in (underlying) subject position (such as (13f), (13g)).

It is thus impossible to speak of the \textit{-ima} rule as associating the predication of the derived Verb with a particular syntactically defined argument position of the base Verb. Rather, it seems that we want to think of the rule as deriving a predicate which is applicable to the argument bearing the \textit{THEME} $\theta$-role in the thematic structure of its base. Where the base has only a single argument, this is assigned a role including the substantive content of \textit{THEME}; where the base has more than one argument, the $\theta$-role of \textit{THEME} is typically assigned

\textsuperscript{11} This brings to mind a joke attributed to Abraham Lincoln. A: “If you call a tail a leg, how many legs does a cow have?” B: “Five. Obviously.” A: “No, four. Calling a tail a leg doesn’t make it one.”

\textsuperscript{12} This “Unaccusative Hypothesis” is particular associated with work of David Perlmutter within the framework of Relational Grammar and of Luigi Burzio within Government and Binding theory. We make no attempt here to provide background references for a position that has become part of the standard apparatus of most syntactic theories.
to an NP in Direct Object position. The correctness of this characterization is confirmed by the fact that (13a), (13b), etc. have the senses indicated and cannot mean *"able to cut, break, etc. (something)." This in turn supports the conclusion that lexical rules of derivation can refer to specific θ-roles, though there is no reason to believe the same is true of genuinely syntactic principles.

A somewhat less stereotypic example of the reference of derivational rules to thematic relations is provided by the lexical suffixes that express locative notions in Kwak'ala. There are a great many of these, specifying locations that are sometimes quite specific (see the suffixal material dzu-xst'and "on a flat surface on the hand" in example (8b) above). In general, the locative suffixes specify a location attributed to the argument assigned the θ-role of THEME by the complex Verb of which they are a part. Again, this argument may appear either in Subject position (with intransitives) or as an Object (with transitives), as illustrated below:

(14) a. kwa"-il "stands on floor in house"
    b. gi-k'ən-d-ala
       put-on log-TRANS-CONT
       "to put something on a log"

The interesting point is that this association of location as specified by locative suffixes with the THEME of a complex Verb is substantially grammaticalized. In the following example, for instance, the ill-formedness of the sentence is due to the fact that the THEME of the Verb is the NP [x]uχw da qaqadinux "these flies," but the locative suffix il "[on the floor] in the house" cannot refer to the flies, who are flying around in the air, but rather refers to the AGENT/SUBJECT "I":

(15) * lala"madz-il-αnla-xux"da qaqadinux
    try to kill-[on floor]in house-1-OBJ-DEM flies
    "(I'm in the house trying to kill these flies)"

The rules of word-internal morphology, then, not only have different content from those of the syntax, but refer to a class of primitives (the content of θ-roles) which are not generally considered to be available for syntactic manipulation. In a language like Kwak'ala, however (and in polysynthetic languages in general), the rules of the morphology are quite rich in descriptive power. Part of this power comes from the sheer size of the inventory of derivational formations the language presents (see Boas 1947), and part from

\[13\] See Anderson 1977a for some discussion of this generalization.

\[14\] The θ-criterion, which requires that every argument be assigned one and only one θ-role, is of course not an exception to this, since it refers merely to the existence and uniqueness of θ-role assignment, not to the substantive content of the θ-role assigned.
the complexity of their interactions. The derivational rules of K*ak*’ala show a degree of recursiveness, for example, as illustrated by the fact that some pairs of suffixes can be attached to one another in either order with semantically distinct results:

(16) a. ni’nak*-ižsd-amas “cause to want to go home”
    b. q’aq’ož-amadz-ižsd “want to teach, want to cause to learn”

We conclude, then, that in K*ak*’ala there is a richly detailed set of principles governing the internal structure of words, as well as an equally detailed set of principles governing the structure of phrases; and more importantly, that the two sets of rules are distinct. It follows that in this language morphotactics cannot be reduced to syntax. Such a language would appear to pose problems for a program which treats the placement of individual morphemes as the responsibility of the syntax regardless of their organization into words, where syntactic and morphological structure are imposed as two parallel but independent organizations of the same surface material. On such a theory, the syntax does not respect (or even know about) the boundaries of words; but in K*ak*’ala at least, it is clear that the syntax must organize exactly the independent words of the language into phrases, with a quite different system being responsible for the internal structure of words.

2.2 Morphology vs. syntax in general

The previous section was devoted to establishing the proposition that the rules of a particular language (in this case, K*ak*’ala) may divide into two distinct subsets, one of which is responsible for the composition of words and the other for phrases. As we noted at the beginning of this chapter, early generative grammar assumed that only a single set of rules was involved in the composition of sentences out of basic morphological elements (morphemes), and thus the theory of syntax was intended to include an account of structuralist morphotactics. When this view was challenged on syntactic grounds in the early 1970s, however, by works such as Chomsky 1970 and Jackendoff 1975, it gradually came to be accepted by syntacticians that rules distinct from those of the syntax operate in the lexicon to describe words. As a consequence of this move, it became clear that the existing theory of syntactic operations and their properties needed to be supplemented by a theory of lexical rules.

It was immediately noted that, in principle, many of the same constructions could be described either by a lexical rule or by a (non-lexical) syntactic rule.
Why have a morphology at all?

For example, passive sentences might be described as derived by movement (together with associated changes) from underlying active sentences. They might also be described, though, by relating active Verbs lexically to passive participles. The active Verb of such a pair has transitive subcategorization, and assigns the 0-role of AGENT to its Subject and that of THEME to its Direct Object. The passive participle, in contrast, is marked in such a way as to preclude a surface Direct Object and to assign its 0-roles differently (THEME to its Subject, AGENT to an associated by-phrase if one is present). The passive sentences are then generated more or less directly, as the result of choosing a passive participle rather than an active Verb from the lexicon. It is in this sense that we can speak of syntactic and lexical accounts as covering the 'same' phenomena. Given a particular construction, described in a particular way by syntactic rules, we can ask whether a lexical account is available to cover the same range of properties, although, of course, the actual mechanics of the two descriptions will differ in important ways.

An account of the distinctive characteristics of lexical rules first emerged in the work of Wasow (1977), who established a number of criteria for distinguishing lexical from syntactic processes. Extending his remarks and incorporating the collateral comments of Anderson (1977a), there seem to be a number of significant differences that contribute to establishing the class of morphological operations that apply in the lexicon, and their differences from the syntax. The interest of these differences for our present purposes is the fact that, insofar as they exist, they represent a generalization of the language-specific conclusion of the previous section: morphology and syntax represent distinguishable domains of grammar, for which distinct theories may be required, and not just two parts of the grammar which happen in some languages to be separable. Most of the differences between lexical and syntactic rules that can be cited follow as theorems, in fact, from an organization of grammars that separates derivational morphology (responsible for the creation of words, each of which occupies or interprets a unitary position in a syntactic structure) from syntax (which governs the construction of syntactic Phrase Markers, within which words are unanalyzed basic elements). Later chapters will explore this theoretical architecture in more detail.

In earlier work it was assumed that this involved simply making the participle intransitive. More recent theories have assumed that this results from allowing the participle to subcategorize for a Direct Object, but not to assign (abstract) Case to this position, thus forcing the Object NP to move to Subject position. The difference between these alternatives is not relevant here.

The class of morphological operations within the lexicon is roughly coextensive with what is traditionally called derivation, as opposed to inflection. Most of what is said in this section about lexical operations is thus applicable only to derivational morphology. See chapters 4 and 5 below for a discussion of inflection and its relation to syntax.
2.2 Morphology vs. syntax in general

Structure preservation: Lexical rules, but not syntactic rules, are necessarily "structure preserving" (in roughly the sense of Emonds 1976). Since they are by their very nature operations over lexical representations, lexical rules are confined to establishing and describing relations among the arguments of particular lexical items. As a result, while syntactic operations can move NPs into non-argument (or $\bar{A}$) positions, the terms of a lexical rule can only correspond to argument positions. This follows from the fact that lexical rules can presumably refer only to information present in a lexical entry, and by definition $\bar{A}$-positions are not referred to by the properties of lexical entries. In terms of the classical notion of structure preservation, it is clear that no lexical rule could yield an item whose properties corresponded to a configuration that does not occur in base structures. All lexical items – whether basic or derived by lexical rule – must be inserted into the same set of base structures, and so no matter what processes internal to the lexicon are involved in the construction of a given item, it must still fall within the syntactic range open to non-complex words. To the extent that non-basic structures can be derived in the syntax (by adjunction or movement to $\bar{A}$-positions), this represents a possibility that is not open to lexical rules. A lexical account of constructions involving movement of $wh$-words to $\bar{A}$-positions, for example, is thus excluded in principle.

Syncategorematicity: Lexical rules may relate items from distinct lexical categories, and indeed derivational processes do this quite commonly (in deriving, for example, Nouns from Verbs). On the other hand, there is no reason to give syntactic rules the power to change category. In general, of course, current syntactic theories do not posit mechanisms that could result in literal change of category: if the only operations that take place in the syntax are instances of "Move-$\alpha$," there is no way for the category label of a terminal node to be changed by this alone. However, much recent work in morphology (beginning with the proposals of Lieber [1980] and Williams...

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17 In fact, there is some theoretical controversy about just how lexical items refer to their arguments. On one account, that of Lexical Functional Grammar, the argument frame of an item includes a specification of correspondences between thematic role and syntactic position – 'Subj,' 'Obj,' '2Obj,' etc. In this case, lexical rules could in principle refer either to the roles or to the associated grammatical positions, but would still be limited to referring to argument positions. On another view, held by some workers within Government and Binding theory, the association between thematic roles and grammatical positions is specified not in individual lexical entries, but rather by a set of – perhaps largely universal – rules. On this view, it is not grammatical positions but only $\emptyset$-roles that lexical rules could have access to. This does not alter the validity of the claim that only properties associated with argument positions are accessible, since by definition no $\emptyset$-role could be assigned to an $\bar{A}$-position.
[1981b]) has assumed that not only stems but also affixes are themselves assigned to lexical categories. Indeed, the essence of Williams's proposal was the somewhat unconventional notion that the (rightmost) affix within a word, rather than its stem, is the categorial head of that word. On this basis, an instance of 'Move-a,' if allowed to operate on affixes (as opposed to whole words as units) could change the category of a word by adjoining an affix belonging to a different category at its right edge. Such a possibility would seriously compromise the intuition underlying most work within the 'Lexicalist' tradition that category-changing operations should be considered lexical rather than syntactic.

Within the view of morphology to be developed in the following chapters, however, the notion that syntactic processes are syncategorematic (i.e. do not change lexical category) will be maintained. This result would follow as a theorem either from the assumption that the syntax treats words as internally unanalyzable, and does not grant syntactic status to affixes, or from the assumption that affixes do not themselves belong to lexical categories. In fact, we will maintain both of these positions below. In chapter 4 we will argue that the interaction between syntax and morphology can be substantively constrained in a way that does not permit the syntax to have access to word-internal elements such as affixes; and in chapter 7 we will argue that there is no reason to associate lexical categories with affixes themselves. Derivational processes that introduce particular affixes may have an effect on the lexical category of the resulting words, but this does not entail the assignment of the affix itself to a lexical category. Rather, the category change and the change in form due to the addition of the affix (or some other formal process) are simply component parts (together with other syntactic and semantic effects) of a Word Formation Rule.

**Locality:** Lexical rules are local in the sense that they can only refer to material within the subcategorization frame of a single item. Syntactic rules, on the other hand, can relate positions not within a single item's subcategorization frame, for instance in the case of 'Subject to Subject Raising' constructions. Again, this difference follows as a theorem from the organization of a grammar. If lexical rules relate one lexical item to another, it is apparent that (without additional stipulated apparatus) the only information available to such a rule would be that present in a lexical item that serves as its input. The only information about other syntactic positions that we have any reason to assume is present in the lexical entry for a given item is that which characterizes its subcategorization frame, and this is exactly the notion of 'locality' which we claim is relevant to lexical rules. Syntactic rules, in contrast, operate over domains characterized by the principles of Government,
Bounding, Binding, etc.: principles which are not in general limited to the immediate subcategorization domain of a single item. They can also affect elements in non-argument or A-positions, items which are (as noted above) inaccessible in principle to lexical rules. The two classes of rule are thus subject to quite different notions of locality.

Reference to grammatical vs. thematic relations: As we have already seen in the discussion of Kwak'ala above, lexical rules may have access to the thematic relations (or θ-roles) associated with particular arguments, while there is no reason to believe a syntactic rule could ever affect, say, exactly THEMES or AGENTS (as opposed to affecting exactly SUBJECTS). Information about the θ-role associated with a given argument position is in general a lexical characteristic of individual items, and we have every reason to expect it to be available to rules operating on lexical items. If these lexical items are not internally analyzed by syntactic rules, however, as we argue is the case, there is no reason to expect such information to be accessible to the syntax.

Relative order: If we grant that lexical rules and syntactic rules are distinct classes, that lexical rules apply to relate lexical items to one another (including the creation of new lexical items), and that syntactic rules apply to syntactic structures whose terminal nodes are interpreted by lexical items, there is a further prediction we might make about the logical relations between the two. In particular, a lexical rule might well presuppose the application of another lexical rule, but it ought not to presuppose the application of a syntactic rule, since such rules could not in principle apply within the lexicon. The usual interpretation of such relations of informational presupposition is as the relative ordering of the rules in question. In these terms the preceding observation can be restated as the claim that lexical rules apply to one another’s outputs, but not to the output of syntactic rules.

Exceptionality: In syntactic theories of the generation of Chomsky (1965), it was widely assumed that the construction-specific transformational rules of the syntax could have arbitrary, lexical exceptions. The move away from construction-specific rules, however, has brought with it the assumption that the very limited set of syntactic rules that remain (perhaps only the single rule ‘Move-α’) are structurally completely general. Lexical rules, in contrast, relate items within the vocabulary of a language, and a primary characteristic of these items is the contingency of their existence: their ‘listedness.’ There is still considerable debate over the extent and mechanisms of arbitrary exceptionality in the lexicon, but it is relatively uncontroversial that insofar as item-by-item exceptionality exists in natural languages, it is a property of lexical relations rather than of syntactic processes.
Rules for the internal structure of words, then, are distinct in type from rules that organize words into phrases and larger constructions. A similar conclusion can probably be derived from the nature of the structural possibilities we find in the two areas of grammar. Syntactic constructions often involve essentially free recursion both on the left and on the right (as well as center embedding) within the same language, and thus grammars for the syntactic structure of natural languages must have (at least) the power of Context-Free Phrase-Structure Grammars (Chomsky 1963). Word-internal structure, on the other hand, where it is not strictly finite, is generally recursive in only one direction. In fact, the only known morphological systems that apparently exhibit genuinely free recursion are those in which the addition of suffixes — hence, recursion on the left — is unbounded. This suggests that the set of morphological systems may fall within the (much narrower) class of Finite-State Languages.\textsuperscript{18} We conclude that morphological processes are substantively distinct from syntactic ones, not only in terms of their language-particular content, but also in their general form. Linguistic theory should therefore recognize a distinction between the processes that organize the internal content of words and those that govern the construction of phrasal (and larger) domains.

2.3 Morphology vs. phonology

Just as the construction of syntactic theories based on the Lexicalist Hypothesis (in various forms) led to the need to treat morphotactics as distinct from syntax, developments in phonology led to the conclusion that allomorphy cannot be reduced to the operation of rules of the phonology. The question here is whether there are formal differences between 'pure phonology' and 'morphology.' When the operation of a given rule is conditioned by morphological factors, and refers to particular morphemes (or classes of morphemes), does it conform to exactly the same principles as one which is conditioned entirely by sound structure? Or are there principles that govern the operation precisely of those rules that refer to morphological factors? As conditions on the sort of phonological rules introduced in Chomsky and Halle 1968 were studied in more detail, it became apparent that principles governing variation in phonological shape observe somewhat different principles,

\textsuperscript{18} The only potential counterexamples to this generalization (see e.g. Carden 1983; Langendoen 1981; Culy 1985) come from the domain of compound formation, and it is precisely such processes whose assignment to the morphology (as opposed to the syntax) is most questionable, as we will argue below in chapter 11.
2.3 Morphology vs. Phonology

depending on whether their conditioning factors are morphological or purely phonological in nature. An early study of these differences is Anderson 1975; the subsequent literature\(^*\) has established a number of other differences, though often without explicit attention to this issue. Among differences which could be cited are the following.

**Exchange rules:** Chomsky (1967) and Chomsky and Halle (1968) drew important conclusions about the internal organization of grammars from the study of such rules, which, as the name implies, effect a complete and exact exchange of two segments in a single environment. The existence of such rules, however, was not securely established, since the principal example cited in this early work was an analysis of the English Vowel Shift rule which was rather controversial in its details and whose properties remain the subject of discussion. Further search did in fact reveal a substantial number of rules of this type, however (see Anderson and Browne 1973). A typical case is that of Diegueño plural formation, in Verbs such as those in (17)

\[
\begin{align*}
&\text{(17)} \quad \begin{array}{ll}
a. & [\text{Pap}] \text{ "burn (sg.),"} \quad [\text{Pap}] \text{ "burn (pl.)"} \\
b. & [\text{mul}] \text{ "gather (sg.),"} \quad [\text{mul}] \text{ "gather (pl.)"} \\
c. & [\text{sa:w}] \text{ "eat (sg.),"} \quad [\text{saw}] \text{ "eat (pl.)"} \\
d. & [\text{ma:}] \text{ "eat a soft thing,"} \quad [\text{mac}] \text{ "eat soft things"}
\end{array}
\end{align*}
\]

Other examples are found in the Nilotic languages Dinka, Dho-Luo, and others, where \([\alpha \text{Voice}] \to [\neg \alpha \text{Voice}]\) in plurals and the “singular appertentive” (a form similar to the Semitic construct state): for example Luo [got] “mountain,” vs. [gode] “mountains,” [god] “mountain-of”; but [debe] “four-gallon can,” [depe] “idem, pl.” What is important to note is the fact that all secure examples of exchange rules share an interesting property: their environments are governed by a morphological category, rather than by purely phonological conditions. This suggests that the formal possibility of exchange rules (which, as noted explicitly from the earliest discussions, would require a formal mechanism distinct from those governing other phonological processes) exists within the class of morphological rules but not elsewhere.

**Interpretation of variables:** As opposed to the historical situation in syntactic theory, the theory of variables in the structural description of phonological rules has not been a widespread object of explicit theoretical interest. Nonetheless, there are a number of issues in the literature that can be subsumed under this heading. Basically, a variable represents the material that is allowed

\[^*\] See especially Janda 1987 for a detailed survey of the evidence surrounding possible differences between purely phonological rules and those that depend on morphological identity.
to intervene between the active factor which explicitly triggers a rule’s application (its “determinant” in the terminology of Howard 1972, one of the few works to treat this issue in comprehensive detail) and a segment directly affected by the rule (the rule’s “focus” in Howard’s terminology). In the strictly linear theories of phonological structure prevalent until the end of the 1970s, the way such material was allowed was by including a term in a rule’s structural description that explicitly analyzed it – either by characterizing it directly, as when one wrote “X C₀ Y” to allow any number of consonants to intervene between “X” and “Y,” or indirectly, as when one wrote something like “A X B, where X contains no [+Coronal] segments.” More recent views of phonological structure place most of the burden of phonological operations on principles that manipulate autosegmental association lines. These theories generally assume the possibility of projecting exactly the relevant material (both the “focus” and the “determinant” of a rule) on some autosegmental tier, in such a way that the material which would have been analyzed by a variable on the earlier approach is not present on that tier, and so the “focus” and the “determinant” are strictly adjacent on it. Indeed, much current work (such as Cole 1987) takes it for granted that rules apply only between adjacent elements, and investigates the issue of how to define representations on which this condition will be satisfied. Within this picture, the notion of a variable is less apparent, but still present: it is simply the principle by which it is determined what material is not to be projected onto the tier of interest.

Bearing this background in mind, we can now discuss a principle that seems to operate differently depending on whether a rule is strictly phonological or involves morphological specification of its environment. It appears quite generally to be the case that variables occurring in rules are interpreted disjunctively if the rule is purely phonological: that is, only the application of the rule corresponding to a maximal interpretation of the variable is admitted. In non-linear theories, this corresponds to the claim that all material excluded from a given tier is irrelevant to a rule operating on that tier, and that such operation always involves elements that are strictly adjacent on a tier. For morphologically conditioned rules, on the other hand, the interpretation of variables is conjunctive: any application corresponding to a possible interpretation of the variable is admitted. In the non-linear case, this implies that every potential focus on a tier is affected, and not simply one that is adjacent to a determinant on that tier.

Some examples of this difference in the interpretation of variables, which will not be repeated here, are cited in Anderson 1975.²⁰ The point of interest

²⁰ The discussion in that paper is in purely linear terms, but the observations and examples are directly convertible into other frameworks.
is the apparent fact that some aspect of the formalism of phonological processes (for example, a claim in non-linear phonology that focus and determinant of a rule must be adjacent on some autosegmental tier) must apply differently within the two domains of rules with (a) purely phonological, and (b) morphologically characterized environments. If we assume that the latter class is in fact a subset of the general class of morphological rules, the difference constitutes a partial motivation for distinguishing these from phonological rules *sensu stricto*.

**Disjunctive ordering:** It has long been agreed that some pairs (or perhaps larger sets) of rules are subject to a condition of mutual exclusivity, such that the applicability of one of them precludes the application of the other(s). Such disjunctive application is apparently governed entirely by a formal condition (commonly known as the "elsewhere" condition, following the terminology of Kiparsky 1973a) when the rules involved are purely phonological in character. Disjunctive ordering among morphologically conditioned rules, on the other hand, is governed by distinct (though not unrelated) conditions. Further, disjunction among morphological (but not phonological) rules may under certain conditions be stipulated on a language-particular basis, as argued in Anderson 1986a. We will discuss the nature of disjunctive ordering relations in (inflectional) morphology in section 5.3.2 of chapter 5 below. The difference between the two sets of conditions governing disjunctive ordering thus provides another motivation for distinguishing theories of phonological and morphological rules.

If we are correct that rules fall under (at least partially) different theories depending on whether they are phonological or morphological in character, this implies a claim about rules whose status changes over time. When a phonological rule is 'morphologized,' for example, we would expect that the theory governing it should change as well. As a consequence, we might find that a rule which in its original, purely phonological form only applied to potential 'foci' immediately adjacent to its 'determinant' would later, when morphologized, come to apply to multiple 'foci' not all of which satisfied such an adjacency condition.

Instances of such a situation can indeed be found. For example, in the early history of the Southern Bantu languages, there was evidently a rule dissimilating labials to palatals or velars before a following /w/ (Doke 1954). In the modern languages, however, this rule has been morphologized in association with a few particular categories in which it was originally motivated

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21 See chapter 13 below and references cited there for discussion of the possibility and mechanisms of such changes.
phonologically – most commonly the passive, marked by the suffix \(-w\). As a result of this morphologization of the environment, the rule might now apply to some labial consonants that are not strictly adjacent to the suffix; and indeed, in Xhosa it applies to all non-root-initial labials within the stem to which the passive is attached.\(^22\) Thus, from the stem \(nqumamisa\) “bring to a stop,” the derivation of the passive form \(nqunyanyiswa\) involves the palatalization of two separate /m/s, neither of which is adjacent to the ‘determinant’ passive suffix (or its constituent /w/). The extension of palatalization to such non-adjacent segments is apparently a concomitant of the rule’s morphologization.

A further Bantu example of the same point can be found (according to John Goldsmith, personal communication) in languages spoken on the eastern shores of Lake Victoria. Here a process of palatalization triggered by the vowel conventionally written \([j]\) has been morphologized, following the loss of an original contrast between \([j]\) and (originally slightly lower) \([i]\). In many, though not all, of the Bantu languages in this area, the causative is now formed by palatalizing all of the suffixal coronals, not just the stem-final one which would have been adjacent to the original causative \([j]\).

A different example of the same general point is furnished by the pattern of Vowel Harmony principles in various dialects of Maltese (Puëch 1978). In this language, original consonantal distinctions of pharyngealization have been neutralized, giving rise to vowel-quality distinctions that have been propagated across words as a system of Vowel Harmony. Puëch notes that the harmony systems vary subtly from dialect to dialect: two parameters of these systems are of interest to us here. First, in some dialects the harmony is purely phonological, in that certain phonological vowels trigger it regardless of any morphological factors. In other dialects, however, it is morphologically conditioned in that harmony in affixes is only triggered by the vowels of the root (and not by those of other affixes). Secondly, some dialects require the harmony to affect only vowels in syllables adjacent to ones containing a triggering segment, while in other dialects it is possible for a non-harmonizing vowel to intervene. Crucially, it is precisely in the dialects in which the harmony has been morphologized that non-adjacent vowels are allowed to be affected, in accord with the claim under examination here.

We conclude that just as lexical rules obey different conditions from those governing syntactic rules, morphologically conditioned rules governing variation in shape obey different conditions from those based on sound structure alone. In fact, such a distinction has been considerably less controversial in

\(^{22}\) See Howard 1972 for discussion and analysis.
2.4 Conclusion

Both in syntax and in phonology, then, the development of the field has seen the re-emergence of a distinct concern with issues of word structure: morphotactics in word formation, and allomorphy in the realization of morphological material. These parallel developments suggest that if the rules of word formation were to be subsumed under either phonology or syntax, it would be at the cost of a distinct weakening of the substantive content of the fields involved. Furthermore, it is clear from the facts of Kwakwala that where one might otherwise anticipate a continuum of principles governing the construction of larger units out of their constituent parts, what is in fact found shows a sharp regard for the difference between domains internal and external to the word. All of these facts suggest that the development of a theory of morphological structure is a well-motivated and distinct object of inquiry within linguistics. The following chapters will attempt to delineate the major properties of such a theory within the context of an overall view of grammatical structure.

23 In the early literature in generative phonology, where the theoretical target was the 'autonomous' phonemics of American structuralist practise, much was made of the significant role of non-phonological factors in the rules governing the relation between underlying and surface form. The resulting theory tended to claim that a single, homogeneous set of rules involving syntactic, morphological, and phonological factors in combination governed this relation. To say that purely phonological rules should be distinguished theoretically from morphological ones, as we do here, does not in itself weaken the claim that an autonomous phonology of the structuralist sort is inadequate. In principle, it implies only that different sets of theoretical conditions govern rules of different sorts, though rules subject to different conditions might well be intermixed in complex ways to define the mapping between underlying and superficial phonological form.
3 Is morphology really about morphemes?

As the discussion in chapter 1 showed, there are historical reasons for the fact that contemporary thought about word structure is so close to the position developed by American structuralist morphologists. In the early days of generative phonology and syntax, the assumptions of structuralists about the nature of words and their component parts were not so much attacked or embraced as ignored; and when morphology came to be studied again, these basic notions were simply taken over unexamined as defining the subject matter. In fact, however, the structuralist ontology was not just a simple and obvious set of postulates, but rather, a carefully constructed theory of word structure, arrived at after a great deal of discussion; and this theory presented notable problems, as recognized explicitly by its developers. We sketch its premises here for this reason, as well as because of the exemplary explicitness of structuralist theorizing about morphology.

3.1 Classical morphemes

The basic fact which a theory of word structure must account for is the observation that complex words show partial phonetic/semantic resemblances to one another. Thus, unreasonable-ness resembles red-ness, un-reasonable resembles un-true, reason-able resembles break-able, etc. It is this set of partial phonetic-semantic resemblances that suggests the decomposition un-reason-able-ness. The theory of morphology is basically an attempt to provide principled grounds for such an analysis.

The starting point for the structuralist discussion of such problems is Bloomfield (1933), whose goal was to provide a firm procedural basis for the analyses linguists arrive at. These procedures were to be based (at least in principle) on a notion of 'contrast' and on the study of the distribution of linguistic elements. In analyzing a language, one was supposed to collect a large corpus of utterances, and then identify the similarities among them, while also determining which utterances 'contrast' with one another. The fundamental principle of such analysis was that non-identical utterances may
still be partially similar to one another in form and meaning. A basic task of linguistic analysis (and of morphology in particular) is thus to characterize these similarities precisely.

The elemental unit of morphological analysis is the morpheme—"a linguistic form which bears no partial phonetic–semantic resemblance to any other form" (Bloomfield 1933: 161). The thrust of this definition is the requirement that phonetic and semantic resemblances be correlated. In other words, it is at the point where further division of the form would destroy the correlation of phonetic with semantic resemblances that the analyst has arrived at its constituent morphemes.

A problem which this approach leaves unsolved (but which was noted in the literature of the period) was the status of "phonaesthetic" elements, such as the gl sequence in English glitter, gleam, glow, etc. Such sound sequences within words certainly meet the criterion of constituting a minimal phonetic–semantic unity internal to larger forms. Most linguists have, however, resisted calling them 'morphemes,' for reasons that are not entirely clear. They appear to meet all formal criteria for morpheme-hood, and so the counterintuitiveness of assimilating them to other morphological units would actually seem to throw some doubt on the claim that the basic intuition underlying our sense of the elements of word structure is that of the recurring phonetic–semantic partial. Nonetheless, it was (and still is) assumed that the extension of the term 'morpheme' can somehow be restricted appropriately.

A postulate of morphological analysis for many writers was (and continues to be) that every form is made up entirely of morphemes. In consequence, when we identify a morpheme within (but not coextensive with) some word, it should follow that the residue after extracting this morpheme is another morpheme (or sequence of morphemes). If this residue occurs nowhere else (as for example huckle, boysen, etc. in the infamous English -berry words huckleberry, boysenberry, etc.), the result is a so-called 'bound morph.'

A morpheme, then, was to be a "minimal same of form and meaning"—an indivisible stretch of phonetic (or phonological) material with a unitary meaning. While this notion is often identified with that of the Saussurean sign, it is in fact a particularly limited view of the sign relation, as compared with that maintained by de Saussure himself (see Anderson 1985b). He apparently held that the domain of the sign relation (the scope within which phonological form is consistently associated with its semantic content) was the word or complex form, not the morpheme or simple form; but this subtlety went essentially unnoticed in developing the observation that correlations can exist between parts of a form and parts of its meaning.

Bloomfield's own use of the notion of 'morpheme' assumes a determinate phonological content, and is thus closer to later use of the term morph or
allomorph. His actual practice, though, is often at variance with his definitions, in that he allows diverse phonological content to be ascribed to the same morpheme (in cases such as duke/duchess, for example, which are said to share a morpheme). A series of subsequent papers within the American structuralist tradition (including Harris 1942; Hockett 1947; Nida 1948, among others) developed and refined Bloomfield’s notion to the form in which it is familiar today.

For these later authors, the morpheme came to be seen as an abstract name for a class of ‘morpheme alternants’ or ‘allomorphs.’ Each of these is required to have a determinate phonological form and to be associated with the same meaning. All of the allomorphs assigned to the same morpheme are required to occur in complementary (or at least non-contrastive) distribution with one another. Some of these ‘morphs’ were allowed to be rather abstract objects, such as phonologically null sequences (‘zero morphs’), the substitution of one content for another (‘replacive morphs’, as in Ablaut phenomena), the deletion of phonological material (as on Bloomfield’s analysis of French Adjectives, where the masculine is derived from the more basic feminine by the addition of a ‘subtractive’ morph which removes the final consonant), grammatically significant reordering without change of phonological content (metathesis), copying of phonological material (as in reduplication), etc.

From this discussion, a consensus emerged on the substantive parallels between the role of morphemes in word structure and that of phonemes in sound structure. Just as utterances could be regarded as built by concatenating the atoms of sound structure, phonemes, so words were regarded as formed by the concatenation of morphological atoms, or morphemes. The basic properties of this classical morpheme were the following:

Morphemes are homogeneous and indivisible atomic units of linguistic form.
Each morpheme in a given word is phonologically represented by exactly one morph, and each morph represents exactly one morpheme.
The morphs themselves are consistently and uniquely (though not necessarily biuniquely) related to surface phonemic form.
The morphemes are arranged into a structure of Immediate Constituents, which yields a sort of Phrase Marker as the analysis of a word’s internal structure.
Words are exhaustively composed of morphemes.

The morphology, on this account, is a set of statements about how these abstract elements are distributed with respect to one another and organized into Immediate-Constiutent structures (the morphotactics); and about how
each is realized, in terms of its morphological and/or phonological environment (the statements of allomorphy). Argumentation generally accepted this picture of the relevant units, and focused on issues such as how the statements were to be organized with respect to each other, and how to define procedures for discovering morphological units. While the assumptions of structuralists about these latter issues have generally been disregarded, their underlying ontology was adopted with surprisingly little discussion in initial generative treatments.

The intuitive appeal of the structuralist morpheme is not hard to see, of course. Any linguist who has had the task of explaining morphological structure to an introductory class has probably had the experience that after seeing only a small number of examples of words analyzed into morphemic constituents, most students can readily extend this analysis to new words, even in unfamiliar languages. Of course, the cases that are readily comprehended are those in which the morphological structure fits naturally with the assumptions above: basically, the kind of structure traditionally called 'agglutinating.' Other, more problematic structural types are much more difficult for students to accommodate to this picture – as indeed they were for the structuralist theoreticians of the 1940s and 1950s.

### 3.2 Classical problems with morphemes

As soon as the consensus picture of morphological structure presented in the preceding subsection was formulated, linguists realized that it hides a number of residual problems. One difficulty, of course, is that the identification of zero, subtractive, replacive, metathesizing, and other "ill-behaved" morphs in a corpus by any sort of mechanical procedure is obviously a "a difficult manoeuver, however desirable" (Hockett 1947: 323f.). An approach to linguistic structure not based on the formulation of discovery procedures does not encounter all of the same difficulties, but these phenomena are still puzzlingly at variance with the overall notion of what morphemes are supposed to be like.

A variety of problems flow from the principles of morphemic structure cited above, when the full range of the word-formational phenomena found in the languages of the world is considered. These can be roughly broken down into two sorts of difficulty: cases in which the internal decomposition

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1 Chapter 12 below will address the relation between traditional typological terminology of this sort and the structure of morphological theory.

2 Both the overall structuralist account and the main points of the critical commentary here are insightfully presented, with much further detail, in Matthews 1972.
of words into morphemes seems to be at variance with the correspondence that 'ought' to exist between components of form and components of meaning; and cases in which some of the apparent components of word form do not seem to correspond to the isolable substrings of segments assumed by the definition of the morpheme. We survey instances of the first kind of difficulty, problems in the relation between form and meaning, in this section.

On the morphemic picture, a complex word is a word form which is made up of a number of formal elements or morphs (the signifiants in Saussurean terminology), and whose sense involves a number of separable components of meaning (the Saussurean signifiés). If the classical notion of the morpheme is appropriate, we should be able to line these up in a well-behaved way. Conceivably, some of the signifiés correspond to more than one element among the signifiants (if the sign is complex, like a 'circumfix'); or more than one signifie might correspond to the same significant (where the meaning of a sign is decomposable on some grounds other than those of the morphology). This ought to be the limit of complexity in the mapping between the two, however, if words are indeed composed exhaustively of morphemes drawn from a lexicon of items each of which has a formal part and a semantic part.

Suppose we say that a word has two representations: one as a string of abstract morphemic units (μ's), linked to components of meaning; and one as a string of phonological positions (Xs), linked to actual phonetic content. Then we can draw lines associating the one with the other. The word *unclear* (phonetically [Anklir]) might have an analysis like this:

(1) ![Diagram](image)

In terms of this sort of analysis, we could represent the classical form of the hypothesis about morphemes as involving the claims in (2):

(2) a. Every X is linked to one and only one μ;
b. Every μ is linked to at least one X; and
c. The lines between Xs and μ's do not cross.

A number of cases, though, present problems in finding, delimiting, and identifying the morphemes in complex words in a way consistent with these
requirements. We usually have a good sense of the fact that a word has certain formal components, and certain components of its meaning, but these are situations in which the two do not line up well—contrary to the notion that words are made up exhaustively of morphemes, and that an analysis into morphemes is the analysis of a word’s internal structure.

One such type of problem is presented in infixes, as in Latin *rumpō* “I break.” Here the nasal infix interrupts the continuous substring of the form corresponding to the root */rup*; cf. *rūpī* “I broke.” The difficulty here lies in the fact that the lines linking segments to the morphological unit */rup* must necessarily cross lines linking the nasal infix to its associated μ.

The other side of this coin is the case of circumfixes, which involve simultaneous prefixation and suffixation that correspond to a single unit of morphological form. The similarity rests in the fact that both infixation and circumfixation result in discontinuous morphological units within a complex form. This particular type of affixation is particularly well developed in some Indonesian and Philippine languages. For example, in Indonesia *ke-...-an* seems to constitute a unit, as indicated by the fact (see MacDonald 1976:63) that the prefix *ke-* “is seldom used, except in conjunction with the suffix *-an*.” Thus, *kebisaan* “capability” is derived directly from *bisa* “be able” rather than by prefixation of *ke-* to a hypothetical *bisaan*, or by suffixation of *-an* to an equally hypothetical *kebisa*. This circumfix can in fact be applied to more complex bases, as in the case of *ketidakmampuan* “impotence,” derived from *tidak mampu* “not be able” (cf. *mampu* “be able”). Its component parts are only marginally and unproductively attested as independent affixes, and not with these roots. The same circumfix also appears in formations like *kehujanan* “be caught in the rain” (cf. *hujan* “rain”) and *kelihatan* “be visible” (cf. *lihat* “see”) where the verbal status of the derivatives is completely incompatible with any claim that the prefix and the suffix represent independent processes that happen to be cumulated in these forms.³

A somewhat different problem is that presented by the existence of empty morphs, or subparts of a form that lack any content whatsoever. Such cases include the thematic vowels that occur in some (but not all) forms of verbs in Romance languages, where all of the categories expressed by the verb are marked by some other part of the form and the theme vowel is simply necessary

³ This is because both *ke-* and *-an*, in the limited circumstances in which they are independently attested as affixes, produce Nouns from various sorts of bases. Corbin (1987: 121–139) argues at some length against the formal possibility of circumfixation (or ‘parasythesis’) as a unitary process. Even if one accepts the large number of unattested intermediate forms required to maintain her alternative (namely, the view that apparent circumfixes are always combinations of suffixation with independent prefixation), this sort of categorical mismatch shows that it cannot be applicable in all cases.
“morphological glue.” In French pens-e-r-ai “I will think,” sent-i-r-ai “I will feel,” etc., the theme vowel (/e/, /i/) makes no contribution to the meaning ROOT–FUT–lsg. It would appear, therefore, that some of the Xs in a diagram like (1) may not be linked to any μ at all.

Superfluous morphs are similar, except that they have a meaning – one that is irrelevant or even incompatible in the form in question. For instance, French doucement is morphologically doux “sweet” + FEMININE + ment “–ly,” but there is no basis for identifying a component “feminine” in the meanings of these adverbs. An English example is provided by words like lengthen and strengthen which appear to be based on the de-adjectival nominals length and strength despite the fact that their meanings (“make longer,” “make stronger”) are apparently based on the underlying Adjectives, not the Nouns derived from these. In these words the nominalizing formative -th (with accompanying vowel change) is something of an embarrassment in the analysis of what would otherwise be a straightforward derivation of causative Verbs from Adjectives. Thus, it seems either that some of the Xs in such formations are linked to no μ or else that the μ they are linked to is not associated in any way with the meaning of the complex form.

Another difficulty in the relation between semantic and morphological form is posed by cumulative morphs, where more than one apparently independent dimension of a paradigm is expressed by a single formative. For instance the -ō in Latin /era “I carry” marks both first-person singular Subject and present tense (cf. /feram “I will carry,” etc.). Since other paradigmatic forms of the Latin Verb represent Subject agreement and tense by distinct components of form, we presumably want to represent these elements by distinct components of meaning. But then it would seem that multiple signifiés are borne by the same μ, contrary to the notion that these elements correspond to minimal signs.

Related to this is the problem of overlapping or portmanteau morphs, as in French du “of the (= de + le).” Similarly, in Breton e dad “his father” vs. e zad “her father” vs. tad “father,” we might regard the initial consonant of the Noun (/d/ vs. /z/ vs. /t/) as functioning simultaneously as part of the signal for the possessor and that for the possessed (“father”), where the portions of the form corresponding to two distinct morphemes exhibit a relation of

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4 Thus, veniebam “I was coming” is morphologically /veni + e:b + am/, as shown by comparison with veniebat “he was coming” and veniam “I will come.”

5 Of course, in this case, most generative phonologists would analyze these facts by saying that “father” is simply /tad/ in all cases, and that there are two different possessive pronouns (both phonologically /e/) which happen to trigger distinct morphophonemic effects (or ‘mutations’) in the root-initial consonant. The overlap indicated here would still be a problem for a structuralist account, where morphs are presumed to be made up of phonemic, and not morphophonemic, material.
overlap or inclusion rather than being disjoint. In such a case, some or all of
the Xs must be linked to more than one μ.

Another type of disparity between the formal and the semantic analysis of
forms is discussed in considerable detail in Aronoff 1976. This can be referred
to as the existence of structure without corresponding meaningful morphemes,
as in English prefix + stem combinations like refer, receive, defer, deceive, etc.
Here all of the conditions for a formal analysis into morphemes re+fer,
de+ceive, etc., are present, but no sensible meaning can be assigned to the
component parts. It would thus seem that such forms contain more than one
μ formally, but that each of the constituent μ’s is linked to the entire meaning
of the form rather than to some proper subpart of it.

The English prefix + stem Verbs represent an extreme case of the common
situation sometimes referred to as reciprocal conditioning, as in Icelandic tek-ur
"you (sg.) take" vs. tók-st "you (sg.) took." Here each of the two components
of the form (the stem and the ending) simultaneously depends both on the
tense and on the person and number of the subject. Such overlapping of the
material representing different categories is in some sense the essence of
the morphological type referred to (rather misleadingly) in traditional
typological schemata of the nineteenth century as 'inflecting' languages. In
fact, in languages like Icelandic, the correspondence between components of
the meaning of a word and those of its phonological form may be quite
complex, as in the following example:

(3) "have" IND SG PRET 2

The word hafðir can be regarded as having five constituent elements that
contribute to its phonological shape: the stem /h(a)f/, the vowel of this stem
(a), and the suffixed elements /-ð/, /-i/, and /-r/. The lines between elements
of the meaning of this form and these formal units are shown in the diagram
above. Each line represents a dependency such that a change in the category
involved could result in a change in the phonological identity of the associated
formal unit. This sort of formal structure is clearly inconsistent in funda-
mental ways with the idealized picture of morphological analysis assumed in
the traditional model.

This collection of problems is perhaps somewhat heterogeneous, but the
frequency with which such situations are met with in the languages of the

\* Cf. hafði 3sg. pret. ind., hofduð 2pl. pret. ind., hefur 2sg. pres. ind., hefðir 2sg. pret. subj.
in support of the links indicated.
world suggests that the principles underlying the structuralist notion of the morpheme must be at least revised, if not abandoned. In the next section, we consider the ways in which the conditions of that model could be relaxed to accommodate such examples.

### 3.3 Generalizing the structure of the morpheme

A number of the problems cited in the previous section revolve around cases in which some apparent "morpheme" does not correspond to a discrete, continuous substring of the segments making up forms in which it apparently occurs. This is the case, for example, with infixes (where the infix itself breaks up the string of segments corresponding to whatever other element it is infixed into), and with circumfixes. Some cases of superfluous morphs could be analyzed as discontinuous morphs as well. Consider, for example, negation in Choctaw Verbs, as in the pair *shiipa* "it's stretched" vs. *ikshii'po* "it's not stretched." The single category **NEGATIVE** is marked here by (a) a suffix -o at the end of the Verb, resulting in the loss of the stem-final vowel; (b) glottalization of the penultimate vowel; (c) prefixed /k-/, separating the stem from (d) a member of a distinct set of pronominal agreement prefixes. If we regard these formal components as independent morphemes, some are clearly superfluous from the point of view of marking negation; but if we regard them as a single combined marker of negation, the resulting morpheme is not a continuous one.

In an important paper for the development of generative morphology, McCarthy (1981) suggested that the appropriate way to approach such problems was by revising the fundamental notion of what constitutes the morphological analysis of a form. The classical model sees morphemes as units, composed of phonological material and concatenated to create full forms. McCarthy proposed that we should instead view the morphological and phonological representations of a form as co-ordinate but independent analyses of it. That is, instead of representing the morphological decomposition of a word by a series of internal boundary elements delimiting its constituent morphemes (as was common both in structuralist and in early generative work), we can give its phonological material a simultaneous analysis as a collection of (possibly, but not necessarily, sequentially ordered) morphological units.

Parallel to the theory of Autosegmental Phonology, McCarthy suggested that each such morphological unit (represented as a mu on the morphological

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7 See chapters 9 and 10 for a review of the issues surrounding such quasi-segmental boundary elements in phonology.
3.3 Generalizing morpheme structure

...
Is morphology really about morphemes?

Figure 3.1 Multiplanar analysis of an Arabic verbal form

presents a formal problem, despite the fact that on other planes (the root-morpheme plane and the vowel-pattern plane) other morphological units are linked to the segmental material which are organized by this syllabic structure. The unusual aspect of Semitic structure, then, consists in the fact that (some of) its morphemic elements appear on distinct planes of representation. From this, together with (a) the independently motivated autosegmental phonological structure of the form, and (b) the well-formedness conditions, the rest of the properties of Semitic verbal inflection can be reconciled with a morphemic model.

An influential series of subsequent papers by McCarthy and others (e.g. McCarthy 1982, 1983, 1986; Yip 1982; Archangeli 1983; Cole 1987) have pursued the analytic possibilities provided by this approach to what has come to be known as non-concatenative morphology (as opposed to traditional, purely affixational or 'concatenative' morphology). Most of this work has focused on the analysis of discontinuous elements in morphology, but it has also extended to some other problems as well. A particular area of activity has been the treatment of reduplication, which will be considered in the following section.

The autosegmental approach to morphology thus revises the traditional view of the phonological structure of the morpheme, to allow morphological elements to be associated with discontinuous parts of a form and/or subparts of the phonological content of individual segments. By interpreting the relation between morphological and phonological content as a matter of associations within and among the planes of a complex representation (rather than as the

* We return in chapter 10 to the question of whether multiplanar representations of morphologically complex forms are motivated, and particularly the question of whether such representations are accessible to rules of the phonology or morphology of language.
concatenation of phonologically instantiated morphological units), at least some of the morphological problems noted by, for example, Hockett (1947) and Matthews (1972) find a satisfying account.

3.4 Items vs. processes in morphology

If we generalize the relation between morphemes and their phonological content along the lines of the preceding subsection, do we therefore evade all of the difficulties for the structuralist notion of morpheme noted in the earlier literature? Manifestly, this approach accommodates infixation, circumfixation, and related problems. By further relaxing the well-formedness conditions, we can describe portmanteau morphs (if phonological material is required merely to be linked to "at least one" \( \mu \) rather than to "exactly one").

Another class of examples, however, poses puzzles of a rather different kind for the usual notion of the morpheme. The difficulties for traditional morphemic analysis that we have just been considering involve either mismatches between the analyses of form and of meaning, or the existence of discontinuous constituents of form. A different set of problematic cases are those in which there does not seem to be any plausible analysis of some morphological element in terms of an isolable, identifiable 'affix' that could constitute the phonological shape of the morpheme.

One such set of examples, noted already by Harris (1942) and Hockett (1950) as requiring special treatment, is provided by morphemes of reduplication (called "chameleon morphs" by Hockett). The problem posed by reduplication for the traditional view of morphemes is simply that the content of reduplicated material is apparently not constant: it is instead a copy of (some portion of) the material to which it is attached. Thus, the reduplicated syllables (in bold face) in the Tagalog verbs \textit{maglalakbay} "to travel (intensive)," from \textit{maglakbay} "to travel," and \textit{paghubuksan} "to open (intensive)," from \textit{buksan} "to open" have no actual phonological segments in common, but nonetheless represent the same morphological element: the 'intensive.'

An account of reduplication in terms of the notion of multiple morphological planes was suggested already in early work of McCarthy (1981). In the description of reduplication, the advantage of this approach is that it admits an association of a particular morphological element \( \mu \) with only a portion of the phonological content of the form. In particular, by analogy with the recognition that Semitic syllabic-structure templates may themselves constitute morphological markers (indicating the binyan to which a given Verb belongs) in a way that is independent of their phonological content, it
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is possible to propose that it is precisely the segmental (or syllabic) structure of the reduplicated material which is the content of a reduplication morpheme, with the associated phonological "melody" supplied by convention. The Tagalog intensive marker is simply the skeletal pattern "CV," added to the stem (following an initial prefix such as mag- or pag- in linear sequence). The process by which the melodic material of the stem's first consonant and vowel comes to be associated with the C and the V of the affix is not, strictly speaking, a part of the affix itself, which can thus be assigned a constant form.

The precise analysis of reduplicative phenomena is not yet firmly established. One analysis, which derives from McCarthy's, is pursued in Marantz 1982, and a variety of alternative views (all based on notions of multiple morphemic planes) have been discussed in the recent literature. Of course, if it is to be maintained that reduplicative morphemes have constant content under this analysis, the crucial point that must be argued is that the actual melodic material associated with this content in any given instance can be supplied by sufficiently general conventions as to eliminate the statement of the association from the description of specific morphemes. This is not at all straightforward, though it has come to be widely accepted in current work that there are enough possibilities for an affinal account that we should no longer regard reduplication as specially problematic for the basic idea of the morpheme.

The correctness of this claim is far from self-evident, since reduplicative formations with essentially the same skeletal form can derive their melodic content from different parts of the base form. Prefixed reduplication, for instance, typically copies material from the beginning of the base form; but in the Austroasiatic language Temiar (Benjamin 1976: 177f.) there is a class of expressive adjuncts formed from bisyllabic Verbs by prefixing a syllable of the form /C₁,eC₂/, where C₁ represents the initial consonant of the root and C₂ represents the root-final consonant, as in the examples in (4).

(4)  
   a. beybøyuy < baguy "to waft (smoke)"
   b. regreweg < rsweg "to stand conspicuously upright"
   c. gengErhrt (phonologically /gEtgerlut/) < gerlut "be long and thin"

   In the related language Semai (Diffloth 1976), there is a very similar process that forms expressives from Verbs by prefixing a vowel-less "minor" syllable consisting of the stem-initial plus the stem-final consonants (e.g., dldy3l "appearance of an object which goes on floating down a river," from the root dy3l). When the stem contains only two consonants, however, the fixed element

10 Voiceless stops at the beginning of medial clusters become nasals by a regular phonological process in Temiar.
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/r/ constitutes the second consonant in the reduplication: thus, hrhac “the sound of dragging something,” from hac. It seems difficult to imagine a set of general conventions for melodic association that will have this effect without requiring a specific stipulation as part of the description of such processes, and such a stipulation would pose difficulties for a strictly affixational account of reduplicative morphology.

Other problems for the notion that all morphemes correspond to separable and determinate subparts of the phonological content of a form are even more lacking in obvious solutions. The simplest case of this kind is that of zero morphs. These obviously have no content at all, which would require us to relax the second condition as well in (2) above. This is not a trivial result: for instance, the assumption that any information which is not overtly signalled nonetheless corresponds to some zero morph leads to the formal problem of assigning a place in the structure (and in linear order) to all of these zeros. Thus, the free positing of zero morphs allows us to say that Latin amo “I love” represents “LOVE + CONJ + INDIC + ACTIVE + PRES + 1PERS + SG,” but in which order (from among the 7!, or 5,040 possible orders)? The formal problems associated with morphological zeros (among others) are discussed at some length by Pullum and Zwicky (1991).

More fundamentally, perhaps, we have apophonic relations (Ablaut, Umlaut, and other morphologically significant vowel or consonant mutations). A familiar example is presented by English sing vs. sang vs. song; or mouse vs. mice. Here it is not the actual content that signals present vs. past (or Verb vs. Noun), or singular vs. plural, but rather a systematic relation between two or more forms. However, the question immediately arises of what the content is of ‘morphemes’ such as {PAST}, {PLURAL}, etc. in these cases.

It is possible to construct a ‘non-concatenative’ analysis, in which the small subset of English in which such apophonic relations appear is treated as analogous to, for example, Classical Arabic. On this line, the Verb sing involves a consonantal root morpheme (\(\sqrt{s-V-N}\)) which occurs with one of two vocalic patterns (/i/ marking “present” and /\(\varepsilon\)/ marking “past”), while the Noun song is built by combining the same root with a vocalic melody /\(\varepsilon\)/. The Noun mouse on this view contains another consonantal root (\(\sqrt{m-V-S}\)) that occurs with vocalic patterns /aw/ “singular” and /aj/ “plural.”

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1 Or as this is sometimes put, that all morphology is ‘affixation.’
2 Terms such as ‘Ablaut,’ ‘Umlaut,’ etc. refer to the historical background of such an alternation, not to its synchronic character. We will in general use the neutral word “apophony” to refer to synchronic vowel alternations of this type, without regard to their historical source. This is not because the history is unknown, but rather because it is irrelevant to the synchronic characterization of morphological rules.
This analysis is not obviously wrong (that is, there is no reason to believe it cannot in principle describe the facts), but it is noteworthy that there does not appear to be any substantive evidence in its favor (as there clearly is, for example, for something like McCarthy’s analysis of Arabic and other Semitic languages). Most analysts find it counterintuitive, though that hardly constitutes evidence. If we are required to provide an analysis that enumerates the morphemes that make up a form, however, and that associates each of these with some determinate phonological content (as on the classical view, augmented by McCarthy’s enriched notion of the nature of this correspondence), this or something very like it is what we must come up with (as structuralist morphologists like Bloch, Hockett, and Nida recognized).

In fact, this mode of description also leads to complications elsewhere in the grammar of English. How, for instance, are we to describe the fact that the Verb *dive* can form its past as either *dived* or *dove*? The existence of the latter suggests that the stem of this Verb should be something like */d-V-y*, with infixes */aj/ “present” and */ow/ “past.” In that case, however, we have no way to describe *dived* as simply the regular formation involving suffixation of */-d/ to a stem: we must rather treat it as involving the addition of a superfluous morph */aj/ “present” to the stem, followed by regular past suffixation. On this account, the regularized form *dived* becomes morphologically more (rather than less) complex than the “irregular” form *dove* which it replaces – surely a bizarre conclusion.

Consider another possible account of the relation, however. Suppose that instead of saying, for example, “*/æ/ is the realization of */pAST/ in *sang*” we say “the *pAST* form of *sing* is formed by replacing */i/ with */æ/.” On this description, what represents */pAST/ in *sang* is not the segment */æ/ but rather the *relation* between *sang* and *sing*, expressed as the *process* by which one is formed from the other.

The choice between these accounts is a familiar one, raised (in one form) in Hockett 1954. The standard view of morphemes, inherited from structuralism, treats them as (phonologically realized) entities or (lexical) items. The alternative suggested in the preceding paragraph, however, treats morphological material as represented by relations (between word forms) or processes (by which one word form can be constructed from another). How might we decide between these two accounts, other than on the basis of an *a priori* preference or commitment to one over the other (the only basis for a preference, according to Hockett 1954)?

If a morphological process necessarily involves some change in the phonological content of a form other than the addition of some (possibly discontinuous) phonological material, it cannot naturally be reformulated as an item whose positive presence in the form marks the category in question.
3.4 Items vs. processes

Another way of putting the issue is the following: is it possible to reduce all of morphology to affixation (admitting the rich notion of 'affix' that follows from autosegmental accounts of the nature of morphemes)? If not, the item-based theory should probably be rejected.

On grounds of descriptive coverage, it seems clear that the process view is (potentially) less restrictive than the item-based view. This is because the presence of any given formative marking a particular category can always be described as a process that adds the relevant phonological material to a more basic stem in the presence of that category; but the opposite does not hold. If we admit morphological processes from other than the limited class of rules of simple affixation, we run the risk of weakening the theory; and this calls for further investigation of the precise formal limits of morphological systems.

One response to the problem of what rule types should be theoretically sanctioned (and which excluded) might be to impose maximally narrow constraints on the expressive power of the rule formalism, so as to exclude rules whose formal character is not instantiated in natural languages. This is a standard form of argument in linguistics, but it may well not be warranted logically in at least some instances. The range of things that are actually attested in natural languages is determined not only by the possibilities made available by the human cognitive-linguistic ability (which linguistic theory attempts to characterize), but also by contingent facts about the world.

For instance, the fact that there are only a finite number of attested human languages obviously means that some theoretically possible systems are nowhere instantiated. More interestingly, constraints from other domains may conspire to reduce the set of attested possibilities. A possibility entertained in chapter 13 is that some rule types are unattested not because they are beyond the bounds of human linguistic capacity, but rather because there is no coherent sequence of possible historical changes that could give rise to them; or at least because such a sequence of changes is so unlikely as to provide in itself an explanation for the absence of rules of the given type. In fact, we find in the phenomena of 'secret languages' or 'language games' a wide range of process types which are not found in natural languages, but with which speakers seem to be able to acquire considerable fluency.

Such rules, we suggest, are possible in these artificial systems precisely because these 'languages' are not the product of natural historical evolution. Since they are not constrained by the limits on historical change, they are freer to exploit the limits of human linguistic capacities. Since it is these capacities that a theory of language seeks to characterize, and not the adventitious set that we find utilized in the actual languages of the world, we

\[13\] For a comprehensive survey of the phenomena attested in such systems, see Bagemihl 1988.
should be careful not to exclude in principle phenomena whose absence is in fact due to the interaction of linguistic capacity with other factors.

These considerations ought to make us reluctant to construct the theory of word structure so as to debar relations that can only be described in processual terms, since such relations can occur as the basis of secret language or language-game systems. Of course, if it could be demonstrated that in fact there is no need to adopt a richer theory of morphology than one limited to rules of affixation, this would be an empirical finding of considerable interest. However, since it is precisely the correct description of prima facie instances of relational, rather than affixational, morphology that is at issue, we should not decide the question on a purely a priori basis if we can help it. We should therefore look to see whether there is other evidence bearing on the possibility that non-affixational processes are among the possibilities encompassed by human linguistic capacities.

Phenomena such as apophony in English do not really resolve this issue either way. An affixational analysis is possible; but in the absence of positive evidence, it is not obviously correct, and it seems (to many, at least) to do violence to the facts. Another area where traditional views saw an argument for non-affixational morphology was reduplication; but as we have seen above, reduplication was argued in McCarthy 1981 and Marantz 1982 to be fundamentally affixational rather than processual in character, when correctly analyzed. There remain some objections to the claim that a comprehensive affixational account of reduplication in, for example, Tagalog is available (see Carrier-Duncan 1984); other problematic examples were noted above. It is also true that the reduction of reduplication to affixation is not complete even on the view of, for example, Marantz (1982), since the (non-trivial) mechanism by which melodic content is associated with the skeletal reduplicative affix must still be specified. Nonetheless, reduplication cannot be said to falsify the claim that all morphology is affixation. Among the problems (traditional and otherwise) for an item-based view of morphemes, however, there are others for which an affixational analysis seems much less likely.

Some languages exhibit 'subtractive' morphs – morphological markers whose formal reflection is in the deletion of phonological material – despite the apparently counterintuitive nature of such an 'anti-iconic' (see Dressler 1985, 1987) way of marking a morphological category. Bloomfield's proposed example of this, gender marking in French Adjectives, is surely not valid (virtually all analyses of French agree that there is no morphologically determined deletion of final consonants to form the masculine from the feminine), but other cases are known. One such is the formation of imperatives in Danish from the infinitive by the truncation of a final schwa (see Anderson 1975 and references cited there, as well as section 9.2 in chapter 9 below).
3.4 Items vs. processes

Crucially, Danish imperatives show phonological properties which follow from general rules if the infinitive is taken as the basic form, but which require that the rule marking the imperative consist not in the addition but the deletion of phonological content.

Similarly, there is a class of action Nouns in Icelandic which are derived from verbs by deletion of the -a of the infinitive (e.g. hamr "hammering," from hamra "to hammer," itself from hamar "(a) hammer"). A number of clear phonological criteria show that these Nouns are formed by a rule of morphology whose sole formal effect is to truncate the final vowel from the base infinitive.

Another instance of subtractive morphology is found in the Uto-Aztecan language Papago (Tohono O'odham). As described by Zepeda (1983: 59ff.), in this language "in most cases the perfective can be derived from the imperative by dropping the final consonant of the imperfective for both singular and plural forms." In a few Verbs, even more material is lost in this formation. Examples of Papago perfective truncation include those shown in (5).

(5)  

<table>
<thead>
<tr>
<th>Imperfective</th>
<th>Plural</th>
<th>Perfective</th>
<th>Plural</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Singular</strong></td>
<td><strong>Plural</strong></td>
<td><strong>Singular</strong></td>
<td><strong>Plural</strong></td>
</tr>
<tr>
<td>him</td>
<td>walking</td>
<td>hi:</td>
<td>walked</td>
</tr>
<tr>
<td>hi:nk</td>
<td>barking</td>
<td>hi:n</td>
<td>barked</td>
</tr>
<tr>
<td>hikck</td>
<td>cutting</td>
<td>hikck</td>
<td>cut</td>
</tr>
<tr>
<td>gatwid</td>
<td>shooting</td>
<td>gatwi</td>
<td>shot</td>
</tr>
<tr>
<td>'elpig</td>
<td>peeling</td>
<td>'eelpig</td>
<td>peeled</td>
</tr>
<tr>
<td>hukṣan</td>
<td>scratching</td>
<td>hukṣa</td>
<td>scratched</td>
</tr>
<tr>
<td>hehem</td>
<td>laughing</td>
<td>hehe</td>
<td>laughed</td>
</tr>
<tr>
<td>cipkan</td>
<td>working</td>
<td>cipk</td>
<td>worked</td>
</tr>
<tr>
<td>meḍ</td>
<td>running</td>
<td>wo:po'ō</td>
<td>ran</td>
</tr>
</tbody>
</table>

This truncation of a final consonant appears to be quite productive in Papago, failing only in (a) Verbs that end in a vowel, which show no truncation (e.g., ciwi "playing, played"), and (b) Verbs, such as the last two in (5), which show truncation of additional material.

Apart from these examples, and others mentioned in Dressler 1987 and Mel'čuk 1989, an interesting case of subtractive morphology has recently been described in some detail in Martin 1988, on the basis of work by Broadwell (1987). Languages of the southwestern Muskogean group show a process of ‘syllable (or rhyme) dissociation’ illustrated below:

* Including the distribution of vowel length; the failure of u-epenthesis in final -Cr clusters; the preservation of final post-consonantal -j, etc. See Orešnik and Pétursson 1977 and Kiparsky 1984 for details and discussion.
66 Is morphology really about morphemes?

(6) a. Alabama
   (i) balaa-ka “lie down (sg.)”; bal-ka “lie down (pl.)”
   (ii) batat-li “hit once”; bat-li “hit repeatedly”
   (iii) kolof-li “cut once”; kol-li “cut repeatedly”

b. Choctaw
   (i) bonot-li “roll up (sg. Obj.)”; bon-li “roll up (pl. Obj.)”
   (ii) bakaaf-li “split (sg. Obj.)”; bak-li “split (pl. Obj.)”

c. Koasati
   (i) atakaa-li “hang (sg.)”; atak-li “hang (pl.)”
   (ii) lataf-ka-n “kick (sg.)”; lat-ka-n “kick (pl.)”

Martin shows that the operation involved in these forms is one which derives the plural (or iterative etc.) form from the singular by dissociating the final syllable from the prosodic pattern and then reassociating its onset consonant melody into the preceding rhyme (if this is possible, consistent with the syllabic structures permitted in the language). Such a process has no apparent (coherent) reformulation as the addition of an affix or other overt ‘morph’ to the form.

Obviously, if the ‘content’ of a putative morpheme is the loss (rather than the addition) of phonological material, there is no way to parse the surface form of a word containing this category so that some (possibly discontinuous) subpart of its structure constitutes the morph in question. It should then follow that the existence of such examples furnishes strong evidence in favor of a morphological theory that recognizes processes other than affixation.

Similarly, if the content of a proposed morph consists not in some subset of the features of a form, but rather in an aspect of their arrangement, there is no obvious way to provide an affixational analysis for it. Such is the case with proposed instances of (morphologically motivated) metathesis. Such rules were discussed in Thompson and Thompson 1969, where a central example was the formation of the “actual” form of Verbs from the “non-actual” in the Salish language Clallam. The content of the “actual” category (a sort of progressive) is not relevant, but its form is: it is apparently derived for roots of the form CCV by interchanging the second consonant with the vowel (cf. čk“ū-t “shoot [non-actual],” čūk“-t “shooting [actual]”). As far as the available facts about Clallam morphology and phonology show, the account of this category as derived by a metathesis rule seems correct, though alternatives may exist. For instance, the corresponding category in

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13 A partial exception to this statement is the possibility of treating the entire prosodic skeleton of a word as a separable part of its phonological content, and assigning exactly this content to some morpheme. This is the case, for instance, with McCarthy’s treatment of the prosodic skeleton of Classical Arabic Verb forms as the phonological ‘affix’ marking each binyan. Such an analysis does not, however, seem appropriate for cases of metathesis as referred to in this section.
3.4 Items vs. processes

the related language Lummi is shown by Demers (1974) not to be derived by a metathesis rule. Rather, the relevant roots contain two vowels, and stress is assigned to the first of these in the 'actual' forms but to the second in the 'non-actual.' Whichever of the two vowels remains without stress is subsequently deleted by independently needed rules of the phonology. On a corresponding analysis of Clallam, the root for "shoot" would have the form /cuk\*u/, and assignment of stress to either the first (in the 'actual') or the second (in the 'non-actual') would result in the deletion of the other vowel to yield the observed forms. On present information, it is not clear whether an analysis similar to Demers's account of Lummi could also be motivated for Clallam.

A recent description (Montler 1986) of another Salish language, Saanich, however, makes it clear that in this language a rule of metathesis is indeed responsible for forming the 'actual' of verbs. Montler demonstrates that (a) phonological rules of the sort crucial to Demers's account of Lummi are not motivated in Saanich (and in fact could not apply there); and (b) the roots showing metathesis in Saanich must actually be underlyingly vowel-less. The stressed position which undergoes metathesis with a root consonant is either epenthetic or belongs to an immediately following suffix. The view on which these roots have vowels in both of the relevant positions, and stress falls on one or the other, resulting in the loss of the unstressed one, is thus excluded. Independently of the structure of the metathesizing roots, Saanich in fact preserves unstressed vowels (including schwa), rather than deleting them. The metathesis account of the formation of the 'actual' in this language thus seems assured.16

If some morphological categories are marked by deleting or reordering existing material, rather than by adding new phonological content, it is surely not possible to reduce all of morphology to affixation without trivializing the problem. Of course, one possible reaction to this is to say that the morphemic model is so valuable that everything ought to be formulated in its terms, no matter what consequences ensue. This leads to the proliferation of zero morphs, some of which have attendant phonological effects (such as triggering rules of apophony, subtraction, metathesis, etc.) which we in fact find in some parts of the literature.17 But this move constitutes a tacit admission that the analysis of complex words into morphemes is no longer an empirical

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16 Another example of an apparently morphological rule of metathesis is provided by the analysis of Latvian in Halle 1987.

17 An extensive defense of what used to be called "Item and Arrangement" morphology (see Hockett 1954) along just these lines is to be found in Bromberger and Halle 1989. The comments on this paper in Pullum and Zwicky 1991 bring out the problems with this program, and seem entirely appropriate.
hypothesis about the structure of language, but rather an \textit{a priori} methodological principle of no independent interest.

Other problems, however, also appear for the "affixation only" program. For example, we pointed out in chapter 2 that morphologically conditioned rules (and only such rules – see Anderson and Browne 1973; Janda 1987) can effect an exact exchange of two segment types in comparable environments (for example, making long vowels short and short vowels long, without any differentiation of the environments in which the two possibilities occur). Obviously, such a case poses a problem for an affixational analysis; for whatever phonological content is appropriate for such a putative affix in one class of cases (e.g. the examples with shortening) will be precisely \textit{in}appropriate for the same affix in the other class (those where lengthening occurs). An extension of this line of argument applies in the case of morphological categories marked by a sort of 'chain-shifting' process. Given a category which is marked by (a) voicing or spirantizing a single stop, but (b) degeminating a geminate stop (as in the morphologized residue of formerly phonological consonant gradation in some Uralic languages such as Lappish), there seems to be no consistent phonological content that can be assigned to the hypothesized affix, even on the rather rich notions of what such content can be that are associated with autosegmental views.$^{18}$

If we accept the evidence that the range of morphological possibilities in natural languages includes some processes that cannot properly be represented as the addition of an affix, we must conclude that a general morphological theory should admit both affixational and non-affixational rules. Since a process-based approach naturally accommodates affixation, but not vice versa, the alternative we should prefer is to explore a theory of morphological processes. Naturally, this is the starting point rather than the conclusion of the development of such a theory. For instance, even though we must evidently include some processes such as apophony, subtraction, metathesis, and exchange rules, this hardly implies that any process that can be represented in a free transformational formalism should be admitted as potentially part of the morphology of a natural language. The appropriate set of restrictions on the phonological changes associated with morphological rules, however, should not be decided purely on the basis of an \textit{a priori} commitment to

\textsuperscript{18} An attempt is made in Lieber 1987 to describe some such cases in terms of affixes that are only partially specified phonetically. Some deficiencies of Lieber's account of Welsh will be noted below in chapter 8, and in any event there does not appear to be any extension of her analysis to instances of 'pure' chain shift. The reason for this is again that whatever phonological content is appropriately added to induce the 'last' link in the chain must not be added to previous links, or the result will be neutralization rather than chain shift. Thus, the Lappish degeminated voiceless stops must not be further voiced or spirantized.
restrictiveness. The remarks above (and in chapter 13) about the interaction between grammatical theory and other constraints such as those on historical change suggest a certain amount of caution in deciding just what portion of the burden of accounting for what is found among the languages of the world should be borne by grammatical theory alone.

If morphology is indeed more adequately represented in the general case by relations or processes than by discrete lexical-item affixes, the consequences are far-reaching. Instead of a lexicon of affixes, the morphology of a language would then consist of a set of rules, each describing some modification of existing forms that would relate them to other forms. If this is the case, some other facts also seem to fall into place. For example, on the view of Lexical Phonology (see chapter 9 below), the rules of the lexical phonology ought to apply to every lexical item. It appears, however, that affixal material must be specifically prohibited from having a phonological cycle of its own (see Kiparsky 1982b), being subject to the lexical rules only insofar as it forms a cyclic domain with some other material. This is exactly what we expect, if the lexical rules apply to the lexicon, and affixal material appears in a word only by virtue of a modification made by some morphological rule. Similarly, the notion of a derived environment, important to an understanding of the conditions under which lexical rules may apply, can be unified if we regard both morphological changes (such as the addition of affixal material) and phonological ones as rules modifying the shape of a form (see chapters 9 and 10).

3.5 Word-based vs. morpheme-based morphology

The notion that morphology is represented by a set of rules rather than by an inventory of items makes contact with another important foundational issue: the claim of Aronoff (1976) that morphology is based on (whole) words, rather than on morphemes, as the domain of the sign relation. Aronoff noted that in the general case, it is only at the level of whole words that form is associated with meaning. Another way of putting this is to observe that both the forms and the meanings of words are potentially internally divisible (disregarding the purely phonological division of word forms into segments, features, etc.); but the relation between categories of meaning and aspects of form is often many-to-many rather than one-to-one. This is the point of a diagram such as example (3) above; it is also the conclusion drawn in Matthews 1972 from points such as those made above in section 3.2. Empty morphs are formatives unassociated with any morphemic content; superfluous morphs are cases where more than one formative is associated with the same category;
cumulative and portmanteau morphs involve more than one category associated with the same formative; and reciprocal conditioning and structure without meaningful morphemes are cases in which a (possibly complex) content is irreducibly linked to several distinct and separable formatives within the complex word. In all of these cases, the one-to-one relation between components of meaning and components of form which is essential to the classical morpheme is violated.

Accepting the conclusion that the basic sign is the word, not the morpheme, Aronoff proposes that morphological rules are also relations between these entities. These **Word-Formation Rules**, on his view, relate one word to another in terms of some specifiable set of changes in properties. A change in the form of the word (perhaps, but not necessarily, the addition of affixal material) is correlated with some change in the syntax (e.g. a change of word class, or of subcategorization requirements, etc.) and/or some change in the semantics of the word. Since the relation between form and meaning exists only at the level of the word, no difficulty is entailed by cases in which a single Word Formation Rule involves multiple changes in a form (as in the case of negation in Choctaw noted above).

The notion that it is words (not morphemes) that constitute lexical entries makes sense of the fact that it is with words (not morphemes) that idiosyncrasies must be associated. Thus, the English word *appreciable* is a perfectly regular formation from the Verb *appreciate* by way of the rule forming Adjectives in *-able* from transitive Verbs; but the meaning is not the expected one ("capable of being appreciated"), but rather "substantial, considerable." One of the most common forms of historical change, in fact, is the accretion of individual, idiosyncratic meaning to particular words, without regard to whether these words are morphologically complex or not.

The claim that words and not morphemes constitute the terms of morphological relations has been rejected by some authors (see Bauer 1979; Lieber 1980; Selkirk 1982; and discussion in Scalise 1984). At least one class of objections to this position can be disposed of fairly directly. If the relevant notion of "word" for a word-based morphology is supposed to be an existing surface word, it is not hard to find abundant counterexamples to such a principle. Consider, for example, formation of Adjectives from Nouns in Latin according to the pattern illustrated by the pair *vir* "man," *virilis* "manly." In this case, the suffix meaning roughly "belonging or pertaining to (Noun)" can be added directly to the occurring nominative singular of the Noun to form the Adjective. But what of other pairs, such as those in (7)?

(7)  a. *vulgus* "common people"; *vulg-āris* "commonplace"
    b. *rēx* "king"; *rēg-ius* "royal"
    c. *mors* "death"; *mort-ālis* "mortal"
3.6 Conclusion

In these cases, the base from which the Adjective is derived never shows up as a word by itself: in every occurrence, it is followed by some ending marking case and number. The correct move here would appear to be to say that it is not words but stems that function as the base of Word Formation Rules. An appropriately constrained notion of stem, in turn, seems to be "word minus (productive) inflectional affixation." If correct, this provides at least the skeleton of an argument to the effect that the class of (possibly complex) forms representing the output of rules of derivation but prior to the operation of productive inflection has a special status in the grammar: essentially, these are the "lexical items" that are entered in a language's dictionary. We will discuss in chapter 4 the implication that inflectional rules are separable from derivation, in that the latter apply to form lexical items, while the former apply to convert these into surface inflected words.

With the modification proposed in the preceding section, then, we accept here the proposition that the morphology of a language consists of a set of Word Formation Rules which operate on lexical stems to produce other lexical stems (which, if fully inflected, will be surface words). On this view, the morphological structure of a word is given as a derivation, showing the set of rules by which it is related to other words (and ultimately to a basic lexical entry). Chapter 10 will discuss some other aspects of a comparison of this view with the more traditional one (represented in the generative literature by work such as that of Lieber [1980], Selkirk [1982], Williams [1981b], and others) according to which a word's structure is given in the form of a Phrase Marker indicating constituency relations among its component morphemes. If some aspects of a word's formal structure cannot in principle be represented as concrete morphemes, however, as we have argued above, it is clear that the traditional account cannot be adequate in general.

There is good reason to explore alternatives to the standard view, but we must, of course, require that these account (at least) for all of the things that the concept of the morpheme and a morpheme-based morphology were designed to cover. Recall that there are two basic intuitions underlying the morphemic account of word structure:

(8) a. Words that are related in meaning are (often) related in form as well. This is captured by saying that they contain the same morpheme(s).
   b. The constituents of a word's form can be organized into a hierarchical structure which also represents the internal organization of its meaning.
and relation to other words. This organization can be presented in the form of a Phrase Marker whose terminal elements are morphemes.\(^{19}\)

In revising the picture of word structure based on classical morphemes, we start from the observation that, in the general case, the class of contributors to the form of complex words looks more like the set of changes made by phonological rules than it does like a lexicon of listed word-like elements. An affix, that is, can be represented by a structural change such as "/X/→/X+aff/," but processes like apophony, subtraction, metathesis, and others cannot be represented as listed elements comparable to /dog/ "DOG" or /-z/ "PLURAL." We thus take the formal constituents of complex words to be not listed morphemes, but rather operations on the form of words. On this view, *dogs* is represented not by concatenating /dog/ and /-z/, but rather by having /dog/ undergo a rule whose change consists of /X/→/Xz/, whenever it represents a Noun with the property of being [+ Plural].

The relation in meaning between *dog* and *dogs* is represented by their sharing a base, since *dogs* is derived from /dog/. The relation between, say, *dogs* and *cats* is represented by the fact that they have both undergone the same morphological process (and of course by their sharing the feature [+ Plural]). These rules thus constitute the basis of relations among words within the total vocabulary of a language.

To flesh out this picture, we need to develop several areas;

(9) a. A theory of how the formal changes that are involved in constructing a complex word are related to the meanings and other properties that the resultant form signals;

b. A theory of what kind of formal changes can make up the inventory of morphological indicators; and

c. A theory of how these morphological operations are related to various notions of structure that we might assign to words, and that we might represent on the traditional view by a hierarchical constituent structure.

The next several chapters of this work will address these issues, among others, in exploring a theory of A-Morphous Morphology. Within the general typology provided by Hockett 1954, which continues to be referred to in the literature, this is an ‘Item and Process’ model of word structure, though, especially in its treatment of inflection, it could also be called a “Word and Paradigm” view. The principal opposition is to “Item and Arrangement” models; and since the dominant, classical picture of word structure based on the structuralist morphemes is firmly of this sort, it is this distinction that is most important to pursue.

\(^{19}\) Actually, even strongly morphemic theories have some trouble with this. The organization that seems to be motivated by a word’s form may be seriously incompatible with the organization motivated by its meaning, giving rise to “bracketing paradoxes.” We will return to this issue in chapter 10.
4 The interaction of morphology and syntax

We saw in the preceding chapters that it is at least worth investigating a theory of word structure based not on the classical notion of the morpheme, but rather on the premise that words are related to one another through the operation of processes called Word Formation Rules. It seems clear that the intuition of relatedness among words, captured on the traditional view by saying that they share a morpheme, can be reconstructed satisfactorily within this alternative approach by saying either that they share a base, that they share a morphologically relevant property such as [ + Plural], or that their derivations involve the same rule. Indeed, in separating these subtypes of 'relatedness' we arrive at a more nuanced view of the matter than one on which words simply do or do not share one or more entire morphemes. The question of how to reconstruct the internal relations of scope among the parts of a word, represented traditionally by an organization of its component morphemes into a constituent-structure tree, will be postponed until chapter 10, when more of the substance of a rule-based view has been developed. As pointed out at the end of chapter 3, there are a number of aspects of such a theory that need to be fleshed out.

In this chapter, we begin that process by asking how the overall domain of word structure is to be mapped out. It might well be the case that 'morphology' is a single and relatively homogeneous subpart of grammar, and this view has been argued explicitly in some places in the recent generative literature. Such is certainly not the traditional view, however: discussions of morphology in traditional and descriptive grammars have generally assumed (often without comment) that some of its component parts merit separate treatment. Principal among the overall divisions that have been recognized are inflection, derivation, and compounding. While there are obviously some notions that are common to all of these, it might also turn out that this (or some other) division of the territory within morphology actually corresponds to a natural division within grammatical theory. This would be the case if there were properties, principles, or substantive concepts that pertained only to one (or only to some) of the areas within morphology, in which case it would make perfect sense to develop, say, a theory of inflection, a theory of derivation, and a theory of compounding, in terms of the principles that are
relevant to each individually. To approach the subject in this way is not at all to deny that there are also properties, principles, and substantive concepts that are relevant to word formation in a more general sense.

Now, of course, the fact that traditional grammarians assumed a division of morphology into inflection, derivation, and compounding does not in itself guarantee that there is anything theoretically significant about this set of categories. On the other hand, there does seem to be something intuitive about this division: notice that, while the distinctions among these types of morphology have seldom been carefully and explicitly drawn, a few examples of the categorization of particular processes generally tend to establish quite a strong (and widely shared) sense of how to characterize other examples.

We will begin, therefore, by taking seriously the possibility that the traditional categories correspond to coherent subdomains of morphology. Of these, the topic addressed in the present chapter (and continued in the next) is the description of inflection. We consider in section 4.1 the ways in which traditional grammar has attempted to separate inflection from other areas of word structure, and conclude that none of the a priori bases that have been proposed for this distinction are fully satisfactory. This does not at all mean that there is no point in making it, however, and we suggest that the line between inflection and other sorts of morphology actually corresponds to a fundamental aspect of the architecture of grammatical theory: inflection is precisely the domain in which the systems of syntactic and morphological rules interact. On that basis, we proceed in section 4.2 to the specific details of that interaction. In particular, we suggest a restricted characterization of the informational interface between the syntax and the morphology. The notion of a 'Morphosyntactic Representation' which is developed there is intended to provide all – and only – the information about syntactic form that constitutes the 'content' of inflectional categories. A full elaboration of this structure, then, including the ways in which it can be referred to by rules of both the syntax and the morphology, constitutes a central and substantive part of the definition of 'inflection.'

4.1 What is inflection?

The foundations for a theory of inflection are not in fact very carefully laid in the traditional literature, where the distinction is usually presented in a rather hazy and intuitive way. Naturally, we need to ask why one would want to believe that there is something like a theory of 'inflection' (as opposed to 'morphology,' tout court). In fact, apart from the traditional intuition that there is a distinction to be made, there are several factors that tend to support
the idea that inflection works differently than other kinds of word formation. The importance of these points is not that they constitute in themselves a coherent theory of what inflection is, but rather that they suggest that there is, after all, something about the morphology traditionally called inflectional that makes it worthwhile to explore the distinction further.

4.1.1 Some reasons to separate inflection from derivation

We noted in chapter 3 that Aronoff (1976) argued that morphology should be "Word-based": that is, the elements in the lexicon which serve as the inputs to Word Formation Rules should be words (rather than morphemes). We saw that this is only coherent, however, if we identify the 'words' in the lexicon with surface words minus certain material. In a language like Latin, for instance, where virtually every surface word form belonging to the major lexical categories N, V, Adj has an overt inflection, words that are manifestly derived from others nonetheless do not carry along the inflectional content of any particular surface words. Words such as vulg-āris "commonplace," rēg-ius "royal," mort-ālis "mortal," etc., are derived from vulgus "common people," rēx "king," and mors "death," etc., by the addition of a derivational ending not to a surface word but rather to a stem. The relevant notion of 'stem' in such a language seems to be that of a "surface word, minus productive inflectional material." Notice that derived words are often built on stems that contain other derivational material (cf. English comprehensiveness, from comprehensive, itself from comprehend), but not inflectional material (cf. the impossibility of formations like *mileage, *officialdom, *participatedant, *starvedation parallel to mileage, officialdom, participant, starvation). But this observation, in turn, implies that inflection has a somewhat different position within the overall grammar than derivation.

An interesting argument for the separation of inflection from derivation is based on the fact that inflectional systems often display 'portmanteau' morphs. As noted in chapter 3, these are formatives that realize, in a single unanalyzable unit, values for two or more linguistic categories. An agreement marker that indicates simultaneously the person and number of a Verb's Subject and the same properties of its Object, for instance, would be an inflectional portmanteau. Consider the partial paradigm of the Verb "see" with the non-future suffix -k in Yuma (see Halpern 1946), shown in table 4.1.

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1 Within the usual view of Lexical Phonology (see Kiparsky 1982a; Kaisse and Shaw 1985) the impossibility of derivational formations built on productively inflected bases follows from the fact that inflection appears on a later lexical level than derivation in English. The generality of this relation, however, is itself in need of an explanation, as we will observe below.

2 This was suggested to me by David Perlmutter.
Table 4.1  *Yuma agreement markers*

<table>
<thead>
<tr>
<th>Subject</th>
<th>Object (Singular)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1st person</td>
</tr>
<tr>
<td>1st person</td>
<td>-</td>
</tr>
<tr>
<td>2nd person</td>
<td>?an'm-ayû-k</td>
</tr>
<tr>
<td>3rd person</td>
<td>n²-ayû-k</td>
</tr>
</tbody>
</table>

While there are some tantalizing similarities among the verbal markers, it is not possible to decompose them into a “Subject” marker and an “Object” marker.

It seems to be the case that portmanteaux are much rarer in derivation (if indeed such elements exist at all). What is most relevant here, however, is the observation that there do not ever seem to be elements which combine inflectional and derivational categories in the same portmanteau. If there were, there might be an element which represented, say, “causative with 2pl. Object,” but such combinations are not found in natural languages. The fact that the two sorts of morphology are apparently unwilling to combine with one another suggests again that there are important differences between the grammatical roles of inflection and derivation.

Modern Hebrew makes productive use of a process of ‘Extraction’ (see Bat-El 1986, 1989), by which new words are constructed by transferring the consonants of an existing word to a new pattern. Interestingly enough, the consonants that are extracted in this way may include some that belong to an affix, perhaps even in the form that affix takes after being affected by a phonological rule. It is only derivational affixes, though, and not inflectional ones, that can be transferred in this way through extraction.

(1)  a. tV- + kicer “to shorten” ⇒ takcer “summary” ⇒ tikcer “to summarize”
    b. xišv “to calculate” + -on⇒ xešbon “calculation” ⇒ xišben “to calculate”
    c. /hi + t + sakel/ ⇒ histakel “to observe” + -an “agent” ⇒ staklan “observer”

3 We appeal for the present to a presystematic, intuitive notion of what morphological material represents ‘inflectional’ vs. ‘derivational’ categories. Of course, the force of the observation depends on the substance given to this notion. We will see below that the difference between inflection and derivation inheres not in substantively defined categories, but in particular instances of rule application. The reader is asked to accept at this point the claim that this and other refinements of the distinction between the two types of morphology do not in fact affect the empirical force of the observation made here with respect to any known instances in actual languages.
In all of these forms, material from derivational affixes (a prefix in (1a), a suffix in (1b) and (1c)) is transferred via Extraction to forms based on derived words. The example in (1c) is particularly interesting, since (a) only the consonant from the derivational prefix /t/, and not that from the inflectional prefix /hi-/4 is extracted; and (b) the sequence /s–t/ which is extracted here represents the result of applying a rule of metathesis to the underlying sequence /t–s/.

What is important for our current concerns, however, is the basic observation that derivation and inflection differ in the way they interact with Extraction.

It has long been observed that in forms where both derivational and inflectional morphology are overtly represented, material corresponding to productive inflection comes "outside of" other morphology. That is, where two or more suffixes are involved, inflectional ones come after derivational ones; and where prefixes are involved, inflectional ones come before derivational ones. Even where a prefix and a suffix are involved, an argument can sometimes be constructed for the relative order in which they must have been added to the stem, and in such cases as well the derivational material seems to be added prior to the addition of productive inflection. This fact is encoded in Lexical Phonology as the otherwise unexplained observation that productive inflection always comes on the last level of the lexical morphology/phonology. We will have more to say about this below; for now it will suffice to note it as another apparent asymmetry between derivation and inflection.

Finally, we can note that some aphasic patients (see Micelli and Caramazza 1988; Badecker and Caramazza 1989) show a loss of control of inflectional morphology (as well as syntax) while retaining control of derivational morphology. Arguments from such cognitive neuropsychological data to the architecture of the underlying system that determines linguistic competence are, of course, difficult to evaluate, but there seems to be compelling evidence that inflection and derivation correspond to aspects of linguistic competence with distinct instantiations in the performance system, as in theory.

4.1.2 How shall we define inflection?

As pointed out in Anderson 1982, the traditional literature usually relies on a few examples to establish the difference between inflection and other sorts of morphology rather than an explicit definition. This is perhaps just as well, because the attempts one does find in various scholars' work to provide a foundation for the distinction do not seem to work very well.

One often cited basis for distinguishing inflection is the dimension of

4 See Bat-El 1989 for discussion of the difference in status of these two elements.
productivity. Inflectional processes are generally more productive than derivational ones. But even if we knew what this meant (productivity can be measured many ways: see Aronoff 1976), we would still have problems. For instance, we want to say that ‘plural’ in English is inflectional even though the formation found in words like *oxen* is completely non-productive.

Perhaps a more dramatic example is that of verbal agreement in Basque. In this language, finite Verbs can be inflected to agree with Subjects, Direct Objects, Indirect Objects, and even some other participants. Every main clause has a finite Verb, which shows such agreement. However, according to Lafitte (1962: 188), “Sur des milliers de verbes, trois douzaines à peine ont une conjugaison forte [i.e. finite] et la plupart l’ont incomplète. Mais tous, même les verbes forts, ont une conjugaison périphrastique.” We would surely want to say that verbal agreement is an inflectional category in Basque, despite the fact that for all but a small set of Verbs this is only marked on an associated (periphrastic) auxiliary chosen from a small, essentially closed class.

On the other hand, even a completely productive process can still, arguably, be derivational, such as the formation of English nominals in *-ing* from Verbs (as in *John’s three recent sightings of the yellow-crested titmouse*). We might well want to say that this is a derivational relation, since it involves a change of lexical category (from Verb to Noun), but it is applicable to any Verb in the language. A high degree of productivity thus does not seem to be either a necessary or a sufficient criterion for calling a morphological category ‘inflectional.’

It is also often noted that inflection and derivation, as usually understood, may differ with respect to the syncategorematicity of the relation marked by a particular rule. Inflectional rules do not change word class (that is, a Verb marked [+ Past] is still a Verb), while derivational ones can. This is probably a necessary property of inflections, but not a sufficient one. Thus, the formation of *racism* from *race*, or of *ex-president* from *president* are presumably derivational rather than inflectional, even though both terms of these relations are Nouns.

Inflections do not change meaning, while derivational formations typically do, and so we might attempt to distinguish the two classes with respect to semantic neutrality. There are probably counterexamples to this proposal in both directions, however. In Chinese, for example:

> The retroflex suffix, *-er*, is the only nonsyllabic suffix in Mandarin. It merges with the syllable preceding it to form a new syllable ending in the retroflex sound, as in these examples:

5 “Of the thousands of verbs, barely three dozen have a strong [finite] conjugation, and the majority of these are incomplete. But all, even the strong verbs, have a periphrastic conjugation.”
4.1 What is inflection?

The rules governing the phonology of the merging of the retroflex suffix with the preceding syllable are presented in detail in [Chao 1968]. The range of frequency of the retroflex suffix varies from dialect to dialect within the Mandarin dialect family. It is most prominent in the dialect of Beijing.

Etymologically, -er was a diminutive suffix for nouns; but it has lost its semantic content in modern Mandarin, and its distribution in the Beijing dialect has been extended to other parts of speech, including some place words, time words, verbs, and classifier/measure words, as a purely phonological phenomenon ... Basically, the retroflex suffix remains a nominal suffix as it once was when it served as a diminutive suffix. (Li and Thompson 1981: 39f.; my emphasis)

The difference between forms with and without -er seems to be purely a matter of style. There is no reason whatsoever to think of it as inflectional, and it thus seems to be an instance of a derivational affix which makes no change in the meaning of the base to which it is attached. Very similar, but distinct phenomena are reported for other Chinese languages in Lin 1989. In the Pingding dialect, for example, an infix consisting of a retroflex [] may be inserted between an initial consonant and the following syllable nucleus, often with no discernible change in meaning. From /pʰhɔ tʰan/ “waiters,” for instance, it is possible to derive [pʰɔ tʰan] with the same sense. In the Chengzhou dialects, a suffix /-u/ occurs which has the same property of leaving unchanged the meaning of bases to which it is attached.

On the other hand, marking a Noun as ‘plural’ surely does not leave its meaning unaffected: the meanings of dog and dogs are not the same, despite the fact that ‘plural’ is surely inflectional in English. One could of course say that this is actually an instance of ‘inflectional meaning’ as opposed to some other, presumably more ‘genuine semantic,’ meaning, but in the absence of a serious theory of such a notion it simply begs the question.

It is also often argued that words differing only in their inflection group together into paradigms, but this is of little help in identifying ‘inflection’ unless we know when words should be said to belong to the same paradigm. The usual, not very helpful, answer is: when they differ only in inflection. This is not at all to deny that, once we know which differences to treat as inflectional, the paradigm itself might well turn out to be a useful concept. This point is argued extensively and persuasively by Carstairs (1986) and especially Matthews (1974), among other recent writers. Nonetheless, to take
the notion of the paradigm as a solution in the search for a definition of inflection would apparently be circular.

It is argued in Borer 1984 that the Projection Principle should be formulated as a constraint to the effect that the features of a lexical item must be preserved throughout a (syntactic) derivation. In consequence, when some feature is not preserved, the relevant derivation must take place elsewhere: for instance, in the lexicon. We could then call processes within the lexicon 'derivation' as opposed to ones that can take place in the syntax, or 'inflection.' This proposal has some substantive considerations in its favor, since the Projection Principle in syntax clearly has the implications Borer assumes. Before we could use this fact to delineate the domains of 'inflection' and 'derivation,' however, we would need first of all to say what 'features' are in question in the above formulation. Borer, in particular, argues that formations such as that of redraw from draw in English must take place in the lexicon because they do not preserve semantics. But we have just seen that semantic neutrality is probably neither necessary nor sufficient for calling something 'inflectional.' This is not at all a trivial difficulty, and until independent criteria can be found for distinguishing the features that may be changed in the syntax from those that must be preserved, Borer's proposal cannot be regarded as providing the required definition. The treatment suggested below (and in the following chapter), however, is quite close to Borer's in spirit.

Finally, if all else fails, it seems we could surely give a list of the things that we wish to call 'inflection' as opposed to derivation: categories such as number marking, Verb agreement, etc. But even this last-ditch attempt does not work, in the general case. For instance, diminutive formation is surely derivational in English (cf. the formation of piglet from pig), German (cf. das Fräulein "girl, young lady" from die Frau "lady"), and most other languages. In Fula, however (see Arnott 1970; MacIntosh 1984; Anderson 1976a for discussion and description), the relation between Nouns and their diminutives is integrated into the exact same system as the marking of number, and functions in agreement in exactly the same way.

Nouns and Adjectives in Fula are marked as belonging to one or another of ca. twenty-five nominal classes, each marked by (a) a distinctive suffix, and (b) one of three possible 'grades' of the initial consonant of the stem. A given Noun has a 'paradigm' consisting of singular, plural, diminutive,\(^7\)

\(^6\) The precise number of nominal classes depends in part on dialect and in part on how one counts a few cases in which it might be possible either to recognize a single class or two homophonously marked classes. These details do not affect the present discussion.

\(^7\) Indeed, many Nouns have two distinct diminutive singular forms, one of which has pejorative connotations while the other is emotionally positive or neutral. The pejorative diminutive constitutes another Noun class exactly parallel in formal terms to the others illustrated here.
4.1 What is inflection?

Table 4.2 Range of classes occurring with nen- “person” in Fula

<table>
<thead>
<tr>
<th>Class</th>
<th>Noun</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>'O</td>
<td>ned-do</td>
<td>“person”</td>
</tr>
<tr>
<td>ɓe</td>
<td>yim-ɓe</td>
<td>“people” (suppletive stem)</td>
</tr>
<tr>
<td>Ngel</td>
<td>nen-ngel</td>
<td>“little person” (diminutive)</td>
</tr>
<tr>
<td>Koyŋ</td>
<td>nek-koyŋ</td>
<td>“little people” (diminutive pl.)</td>
</tr>
<tr>
<td>Nga</td>
<td>nen-nga</td>
<td>“big person” (augmentative)</td>
</tr>
<tr>
<td>Ko</td>
<td>nek-ko</td>
<td>“big people” (augmentative pl.)</td>
</tr>
</tbody>
</table>

Table 4.3 Sample of classes occurring with maw- “big, important” in Fula

<table>
<thead>
<tr>
<th>Class</th>
<th>Adjective</th>
<th>Approximate meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>'O</td>
<td>maw-do</td>
<td>“important (person)”</td>
</tr>
<tr>
<td>ɓe</td>
<td>maw-ɓe</td>
<td>“important (people)”</td>
</tr>
<tr>
<td>Ngel</td>
<td>man-ngel</td>
<td>“important (little person or thing)”</td>
</tr>
<tr>
<td>Koyŋ</td>
<td>mak-koyŋ</td>
<td>“important (little people or things)”</td>
</tr>
<tr>
<td>Nga</td>
<td>man-nga</td>
<td>“huge (person or thing)”</td>
</tr>
<tr>
<td>Ko</td>
<td>mak-ko</td>
<td>“huge (people or things)”</td>
</tr>
<tr>
<td>Ngu</td>
<td>man-ngu</td>
<td>“big (e.g. horse)”</td>
</tr>
<tr>
<td>Ki</td>
<td>mak-ki</td>
<td>“big (e.g. tree)”</td>
</tr>
<tr>
<td>Nde</td>
<td>maw-dne</td>
<td>“big (e.g. book)”</td>
</tr>
<tr>
<td>Nge</td>
<td>man-ngge</td>
<td>“big (e.g. cow)”</td>
</tr>
<tr>
<td>dum</td>
<td>maw-dum</td>
<td>“big (thing)”</td>
</tr>
<tr>
<td>Ndi</td>
<td>maw-ndi</td>
<td>“big (e.g. bull)”</td>
</tr>
<tr>
<td>dʃi</td>
<td>maw-dʃi</td>
<td>“big (e.g. horses)”</td>
</tr>
<tr>
<td>ɗe</td>
<td>maw-ɗe</td>
<td>“big (e.g. beans)”</td>
</tr>
<tr>
<td>Ka</td>
<td>mak-ka</td>
<td>“big (e.g. speech)”</td>
</tr>
<tr>
<td>Kol</td>
<td>mak-kol</td>
<td>“big (calf)”</td>
</tr>
</tbody>
</table>

augmentative, diminutive plural, and augmentative plural forms. The basic class to which a Noun belongs is essentially an arbitrary lexical fact (though certain semantically based subregularities exist for parts of the lexicon). Given this basic lexical categorization, however, the same Noun can appear in more than one class, as illustrated in table 4.2, taken from Macintosh (1984: 48). Adjectives can similarly appear with the suffix (and associated consonant grade) of any of the Noun classes, as illustrated in table 4.3.

The nominal class system is pervasive in Fula agreement morphology. Adjectives, Quantifiers, Demonstratives, etc., appear in the same class as the Noun they modify; distinct pronominal sets exist to refer to elements of
different classes; and Verbs contain pronominal elements referring to (phonologically null) NPs that differ depending on Noun class. What is important to note about this system is the fact that the difference between a basic Noun and its diminutive is formally an exact parallel to that between the Noun and its plural; or between the Noun and another that happens to belong (as an arbitrary lexical fact) to a different class. Thus, in this language, diminutive (and augmentative) formation is formally part of the same system as that marking 'gender' (nominal class) and number, a system which we would certainly want to call inflectional. In languages like English, in contrast, diminutive formation is surely a derivational matter. The same category of word formation, in substantive terms, can thus be inflectional in one language and derivational in another, preventing us from defining this distinction ostensively.

While the range of possible bases for distinguishing inflection from derivation that we have just surveyed is not exhaustive, it does seem to be representative of the attempts that have been made in the grammatical literature. All of these, apparently, identify properties of inflection (as opposed to derivation) that are either accidental, or incorrect, or merely necessary (as opposed to necessary and sufficient) as characterizations of the general class. We must conclude that a legitimate basis for this intuitive categorization of morphological processes has not yet been established.

4.1.3 The substance of the notion of inflection

Thus we see, on the one hand, that there is probably some justification for treating inflection as a part of morphological structure with properties that are (at least to some extent) distinct from those of derivation and compounding; but, on the other, that the attempts in the traditional literature to provide a foundation for this distinction are generally unsatisfactory. Let us, then, take a closer look at the range of properties that seem intuitively to go together as 'inflectional,' in order to see whether some other approach to the distinction suggests itself.

We can divide the properties which would traditionally be called 'inflectional' into four general types, as indicated in (3) below.

(3) a. Configurational properties, which are assigned on the basis of the larger syntactic structure within which a word appears. An example is the genitive assigned to NPs in the determiner position within English NPs, as in \[NP \_{Det} \_{NP\_{Gen}} \text{John's} \text{hat}\]. Case is the commonest example of this kind of property, but it is not the only one.
4.1 What is inflection?

b. **Agreement** properties, which are assigned to words by reference to the value on a particular 'paradigmatic dimension' of some other item within the same syntactic structure. For instance, in *The cat sleeps on the bed* vs. *The dogs sleep on the floor*, the difference between *sleeps* and *sleep* is a matter of agreement with the Subject NP.

c. **Phrasal** properties, which are assigned to larger constituents within a structure (typically, maximal projections - full phrases), but which may be realized on individual words that constitute only part of those structures. If we think of the English genitive as a morphological category of words,* we could say that the genitive on *England's in the king of England's crown* is the word-level realization of a phrasal property belonging to the containing NP. Note that the category of phrasal properties includes not only, for example, NP case realized on N, but also properties of other domains such as those of tense, aspect, etc. as properties of clauses, which may be relevant to delimiting the domain of binding relations.

d. **Inherent** properties, which are lexical characteristics of individual words that must be accessible to syntactic principles of agreement, etc. in order for these to operate correctly. For instance, agreement in Latin needs to know about the gender of Nouns in order to control the inflection of Adjectives, so we might say that gender is *ipso facto* an inflectional property of Nouns as well as of Adjectives even though the basis of the category is quite different in the two lexical classes.

If we look for what these classes have in common, it seems to be more or less as follows. Let us say that any rule which operates over a phrasal domain (as opposed to operating within a single word) is 'syntactic.' The morphological properties of individual words which we want to call 'inflectional' include ones that are either assigned by such a rule (cases (3a), (3b), and (3c)), or that have to be available to such a rule in order for it to operate (some of the above, plus case (3d)). 'Inflection' thus seems to be just the morphology that is accessible to and/or manipulated by rules of the syntax.

But to say this is to run afoul of an important principle of contemporary syntactic theory. As we observed in chapters 1 and 2, the early 1970s saw the emergence of a sort of consensus around the proposition that word formation and syntax are not inseparable parts of the same domain of grammar. The first appearance of this proposal was limited to the claim by Chomsky (1970: 188) that "we might extend the base rules to accommodate ... derived nominal[s] directly." That is, derived nominals like *refusal* might be related

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* This is probably not literally correct, and it would be more accurate to say that the English genitive is a particular kind of clitic. We will argue in chapter 8 that the phenomena associated with clitics and with word-level morphology are both subcases of the same general theory, however.
to basic Verbs like *refuse* within the lexicon and introduced into syntactic structures directly as Nouns, rather than being introduced as Verbs and then converted to Nouns by syntactic rule. While this is in itself a rather limited claim, the attempt to provide a systematic basis for such a move led rather directly to the position that word formation in general should not be performed in the syntax. A maximally strong form of this position would be something like (4):

(4) **Lexicalist Hypothesis:** The syntax neither manipulates nor has access to the internal form of words.

Principles similar to this have been accepted (explicitly or implicitly) by work within a number of variants of syntactic and morphological theory in the years since Chomsky's original suggestion. As stressed by Di Sciullo and Williams (1987), it would be much more satisfactory if, instead of leaving a principle like (4) at the level of an arbitrary stipulation, it could be shown to follow in a natural way from the architecture of grammatical theory. Later in this chapter, and in others to follow, we will attempt to satisfy that requirement by constructing a framework for grammar within which something like (4) follows as a theorem. Before we can entertain such a possibility, however, we must address the extent to which (4) is valid even as a descriptive generalization. The problem, of course, arises from the fact that what seems to unite the types of morphological property surveyed in (3) best is that they are all systematic exceptions to the Lexicalist Hypothesis.

We could respond to this in several ways. We might conclude simply that the Lexical Hypothesis is wrong. Alternatively, we might claim that in fact none of the processes referred to in (4) are actually performed in the syntax, but rather (as proposed, for example, in Lapointe 1980) a full range of inflected forms are built within the lexicon and then the choice of the correct one in any specific syntactic position is due to the operation of some other part of the grammar.\(^{10}\)

Another possibility, however, is to take the theory of inflection to be precisely a theory of the apparent exceptions that exist to (4), and thus a theory of the ways in which the Lexicalist Hypothesis (considered as a descriptive generalization) must be relaxed from that form. In this sense, we arrive at a theory-internal conception of the nature of inflection: inflection is

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\(^{10}\) In Lapointe 1980, this "other part" was the process of semantic interpretation. Arguments against this specific proposal have been presented elsewhere (Anderson 1982); in any case, it has not been widely adopted, and Lapointe's own later work has pursued different approaches. This line of analysis is cited here only as an example of one path out of the problem presented for the Lexicalist Hypothesis – at least in as strong a form as in (4) – by inflectional phenomena.
precisely that morphology with respect to which principles of syntax and of word formation interact within particular grammars.

4.2 Morphosyntactic Representations

The first question to address is that of just what information is potentially ‘exchanged’ between morphology and syntax. Of course, if they were totally separate, the most extreme possible answer to this would be that they share no information at all. Rather clearly, however, an answer as radical as this cannot be right. Information about major word class, at a minimum, must surely be common to the two if it is to be the case that the syntax determines the structural positions in which Nouns, Verbs, Adjectives, etc., can appear. From this we can conclude there must be an analysis of at least some properties of words which is accessible to the syntax. The question of how syntax interacts with morphology (and thus the theory of inflection, on the view proposed in the preceding section) must involve as a major component the question of what this “morphological analysis” of a form consists of.

4.2.1 The syntactic inappropriateness of morphological form

The usual view of what information might be common to the morphology and the syntax (i.e. what the “morphological analysis” of a form consists of) is that this is a (structured) division of the word into its constituent morphemes, coupled with a gloss for each of these units. Thus, the Georgian word mogklavs “He will kill you” could be assigned an analysis such as that in (5).

(5) mo = g- klav -s
preverb = 2OBJ kill 3SBJ
“He will kill you”

On this account of the analysis of a word, however, a number of problems derive from the assumption that information such as that in (5) is available to the syntax. In fact, we can show that this position is both too weak and too strong to provide an appropriate representation of the syntactically relevant properties of a word.

This position is too weak in the following way. If we take a decomposition of the word into its component parts to be the basis of its analysis, we must face the difficulty that any aspect of its form that cannot be represented as an affix will not, as a result, appear in that analysis. Insofar as significant categories of a word’s morphological structure are represented by operations such as apophony or consonant mutation, truncation, metathesis, or other non-affixal processes, there is no natural way to include these ill-behaved
'morphemes' in the constituent structure of the form. But if they do not appear there, that means that they will not be present in the analysis which is visible to the syntax.

It might, of course, turn out that exactly those aspects of a form that do not correspond to affixes are systematically irrelevant to the syntax, but this seems highly unlikely. For this to be true, it ought to be the case, for instance, that in a language (like English) where the same category (plural) is represented typically by an affix (e.g. cat/cats) but sometimes by apophony (e.g. woman/women), affixed words would trigger plural agreement on an associated word, but those with apophonic plurals would not. Since we find both Cats chase/*chases women and Women chase/*chases cats, we must conclude that [+ Plural] is a feature of the analysis even of those forms where it does not correspond to a separable, affixal constituent of the word.

The only way to avoid this difficulty is to posit, for each (syntactically relevant but) non-affixal component of the form of a word, a corresponding 'zero morpheme' that can serve as a place holder for the aspects of its signifié that are signaled by the component in question. Purely morphological motivation for such additional zero morphemes is generally lacking, however, and, as we argued in chapter 3, they lead to otherwise gratuitous difficulties. On the face of it, these additional zero morphemes are simply a registry of the cases in which the claim that syntactically and semantically relevant aspects of a form are signaled by the presence of corresponding morphemes is incorrect. We must conclude that some representation of a word's properties other than that afforded by its morphologically motivated decomposition into discrete stems and affixes must be provided for the purposes of the syntax.

Notice that the problem here is not alleviated by considering apophonic alternations that signal the plural in English to be a matter of lexically governed suppletion, rather than rule-governed vowel change. There is still no reason to posit a distinct constituent with the gloss 'plural' in the formal analysis of words like women.

This is not to deny that there are ever reasons to assume the presence of formally null components of a word's shape. Under restricted circumstances, some value for a paradigmatic category may be positively signaled by the fact that no other marker occurs to indicate a different value for the category in question. Rules of this latter sort are extremely unusual in the grammars of natural languages: for an example of the sort of argument that might support their existence, see Anderson (1977c: 34f.) as well as chapter 6 below. Nonetheless, the great majority of zeros posited in current analyses are motivated only by the requirement to maintain a strict and exhaustive decomposition of words into morphemes. This is especially true of zeros whose effect is to trigger some non-affixal change in a form, where in fact it is the change itself and not the posited conditioning zero that marks the morphological category.

Note that the example discussed immediately below, in which no formal marker appears in the Georgian Verb in (6) to indicate a first-person Subject, does not involve the formal analog of a zero morpheme. The absence of a marker here follows from the fact that application of the rule which might introduce one is blocked, rather than from an explicit rule stipulating that the category is marked by no change.
Another sense in which the morphological decomposition of a word is too weak to serve as the representation for the purposes of the syntax is the following. In some languages, information may sometimes be conveyed not by constituents that are present in the structure of a given word, but precisely by the fact that certain other material is absent. Consider the Georgian Verb form in (6), for example.

(6) mo= g- klav
    PVBe  2OBJ  kill
    "I will kill you"

This form represents agreement with a first-person singular Subject and a second-person singular Direct Object. Each of these agreement properties is syntactically relevant: apart from the fact that each arises from the presence of properties in the phrasal structure within which the Verb form appears, each is necessary to sanction the presence of phonetically null pronominals. But while an overt affix (/g-) is present to signal agreement with the second-person Object, no affix marks the fact that the Subject of this Verb is (and must necessarily be) first-person singular. This agreement can be inferred from the following information. The Subject cannot be second person, since, if it were, the sentence would be reflexive – but reflexive forms in Georgian are grammatically third person, and this Verb has a second-person Object. Similarly, the Subject cannot be third person, since, if it were, there would be a suffix (/s/) at the end of the Verb. Thus, since there are only three values for the category of Person in Georgian, the Subject must be first person. But it must be singular, rather than plural, since a first-person plural Subject would trigger the introduction of a suffix /t/ at the end of the Verb. We know therefore that the Subject of this Verb must be first-person singular, but this fact is not signaled by the presence of any overt affix in the word. Thus, the morphological analysis of the word does not provide enough information to serve as the representation needed by the syntax.

On the other hand, an analysis of the formal constituents to be found in a word is also too strong for the purposes of the syntax, in the sense that it

13 A traditional analysis of the Georgian conjugation claims that an affix /v-/ is present in the underlying representation of such a form, but that this is deleted in the presence of the /g/- prefix marking second person singular Objects. Such a deletion cannot possibly be motivated on phonological grounds, however, since both /gv/ and /vg/ sequences, even as parts of much more complex clusters, are perfectly well formed phonologically in Georgian. It is argued in Anderson 1984b and 1986a that the non-appearance of /v-/ is a morphological fact, to be accounted for by a disjunctive relationship among the possible prefixes in the structure of the Georgian Verb. There is thus no reason to believe that a first-person singular Subject marker is present at any point in the analysis of this word's form, although the corresponding properties must, of course, be present in the syntactically relevant representation.
provides information which we have no reason to believe is ever employed by or relevant to the rules of that component of the grammar. For example, such a representation must obviously contain information about the relative linear order of the formatives within a word, but there is no reason to believe that such information per se could ever be syntactically relevant. Consider a language like Choctaw, in which most of the agreement markers appearing on Verbs are prefixed to the stem, but one (the 'active' Subject marker -li) appears as a suffix instead: cf. hilha-li-h "I danced" vs. ish-hilha-h "he danced." We would surely not want to admit the possibility that such a difference could be syntactically relevant. For instance, we would not want to countenance a situation in which, say, pronominal elements were required to be linearly adjacent to the agreement marker that they correspond to, so that with Choctaw Verbs like hilha "dance" a first-person Subject pronoun must follow the Verb, but other Subject pronouns must precede it. To generalize from this case, the linear order of formatives within a word is in itself systematically irrelevant to the syntactic characteristics of that word (though, of course, word-internal linear order may be sensitive to independently motivated aspects of the analysis of the form that themselves have syntactically relevant consequences).

A similar point can be made on the basis of words in which the same category is reflected at more than one place. In this connection, consider the inflection of Adjectives in the Kubachi dialect of the Northeast Caucasian language Dargwa (see Magometov 1976 for further information). In this dialect, arguments are classified as referring either to males, females, or non-humans (as well as first vs. second vs. third person); and as singular vs. plural. The set of class markers is shown in table 4.4.

Now consider the agreement pattern in the Adj–Noun NPs in (7):

(7) a. b-ĭk'a-zi-b qalč'e "little bird"
   b. d-ĭk'a-žu-d qalč'-ne "little birds"
   c. w-îk'a-zi-w gal "little child"
   d. b-ĭk'a-žu-b gul-e "little children"

Each of the Adjectives in (7) contains three distinct agreement markers: an initial marker, that agrees with the gender/number class of the Noun; a final marker, that also agrees with the Noun's gender/number class; and a penultimate marker, that agrees only with the number of the Noun. Despite this richness of agreement marking, the inflectionally relevant property of the NP as a whole (and presumably of the Adjective) is simply the gender and number of the head Noun. The syntax does not (and presumably could not, in principle) pay attention to the presence of three separate markers: an intransitive verb whose Subject is one of the NPs in (7), for example, is not
4.2 Morphosyntactic Representations

Table 4.4 (Kubachi) Dargwa class-agreement markers

<table>
<thead>
<tr>
<th></th>
<th>Male</th>
<th>Female</th>
<th>Non-human</th>
</tr>
</thead>
<tbody>
<tr>
<td>Singular</td>
<td>/w/</td>
<td>/j/</td>
<td>/b/</td>
</tr>
<tr>
<td>3 Plural</td>
<td>/b/</td>
<td></td>
<td>/d/</td>
</tr>
<tr>
<td>1st, 2nd Plural</td>
<td></td>
<td>/d/</td>
<td></td>
</tr>
</tbody>
</table>

inflected for more than one argument, as if it were transitive or ditransitive. Information about such multiple marking of the same category, then, while morphologically essential (if the word is to be correctly constructed), is syntactically inappropriate.

Another sense in which the analysis of a word’s form is too strong to serve as a satisfactory representation of its syntactically relevant properties results from the fact that it contains other syntactically irrelevant information besides the linear order of formatives. Thus, the form of a word includes reference to the presence of ‘empty morphs,’ such as the /-t-/ in Menominee ke-t-ōs “your-0-canoe; your canoe,” which is a part neither of the stem nor of the possessive, but merely a mechanical, morphologically conditioned concomitant of the addition of a possessive marker to a vowel-initial stem. Other instances of such empty morphs (see chapter 3) include Romance thematic vowels, among others. Since these elements by definition bear no actual information about the properties of a form that might be relevant to its syntactic behavior, but are required for purely morphological reasons, there is no reason to believe that information about them should be provided to the syntax.

The appropriate conclusion to be drawn from these observations seems to be the following. Some information about the properties expressed by words must evidently be exchanged between the syntax and the principles of word formation, if the properties cited above in (3) are to be correctly reflected in the grammar. On the other hand, there is reason to believe that the actual morphological structure of a word is not the correct form in which this information should be exchanged, since it bears both too much and too little content for the purposes of the syntax. Let us suppose, therefore, that in addition to its formal structure, a Morphosyntactic Representation (MSR), which represents the properties expressed by a word, as opposed to its formal composition. While aspects of

14 That is, in addition to its representation as a phonological Object. The question of whether this should further include an organization into constituent formatives arranged into some kind of constituent structure will be addressed in chapter 10 below.
The interaction of morphology and syntax

A word's phonological form may of course be projected (in part) from its Morphosyntactic Representation, this representation can be given a formal character that abstracts away from details of just what phonological material appears in the word and where it appears relative to other material. Essentially, the Morphosyntactic Representation of a word will consist of an unordered list of its morphologically relevant features – surely the minimal possible representation – though this will be refined below. We can then propose that it is precisely the information present in this Morphosyntactic Representation that constitutes the interface between the principles of syntax and those of word formation.

4.2.2 The role of Morphosyntactic Representations in grammar

Let us pursue the proposal, then, that words have a Morphosyntactic Representation which characterizes all (and only) those properties that are relevant to the principles both of word formation and of syntax. Taking this notion seriously, we might claim that only that information about a word that is encoded in this representation is available to the syntax; and that only that information about the syntax that is provided there is available to the morphology:

(8) The Morphosyntactic Representation of a word is the only aspect of it that is visible to/in the syntax; and the only way the syntax can affect the form of a word is by manipulating its MSR.

We could achieve this result without further stipulation if we were to take the following approach to the organization of the grammar. Let us suppose that the terminal nodes of syntactic representations are not lexical items, but rather Morphosyntactic Representations. 'Lexical insertion' is a process that might better be called 'lexical interpretation,' by which a lexical stem is chosen to interpret each position in a Phrase Marker in a way that is consistent with the lexical requirements of the stem (including subcategorization and other individual constraints). The selected lexical stem can itself be independently inflected (by means of a subset of the language's Word Formation Rules) in accord with the features in the MSR of that position.

This view treats the syntax as describing abstract grammatical structures, without reference to the specific lexical items that will appear in them. Notice that this is essentially equivalent to saying that 'lexical insertion' takes place not at D-structure (as is commonly assumed), but rather at S-structure. Insofar as a syntactic principle operates to relate earlier levels of structure to S-structure, the most that it can know about the lexical items that will appear

15 As we will see in chapter 12, the same view of the interaction between syntax and morphology seems to have been held by Sapir.
4.2 Morphosyntactic Representations

in the S-structure of the sentence is that information which is present in the Morphosyntactic Representations that constitute the terminal nodes of (lexically uninterpreted) syntactic structures. While this approach deviates from much common practice, it is not as radical as it may appear at first. For instance, since the Projection Principle (see Chomsky 1981) ensures that the lexical requirements of lexical items must be satisfiable at every level of structure, it is clear that S-structure lexical insertion ought to be possible. The proposed organization of a grammar is designed to draw a particular conclusion about the nature of the Lexicalist Hypothesis from this fact. One part of that claim (as formulated in (4)) is that, on the view being developed here, the syntax does not have access to the internal form of words (except indirectly, to the extent that this form reflects properties of the Morphosyntactic Representation). Having lexical insertion take place at S-structure ensures that information internal to a lexical item is simply not available to the syntax.

As we will see below (and in chapter 5), this view of the interaction of morphology and syntax has important consequences in both domains. Before we can explore those implications, however, we must say considerably more about the objects through which the syntax and the morphology are assumed to pass information: the Morphosyntactic Representations. An immediate question is the following. Since these objects are assumed to be accessible in the syntax, the syntax can make changes in them. We need some sort of account of the range of manipulations of these representations that the syntax can perform.

Recall that we are attempting to maintain as strong a form of the Lexicalist Hypothesis in (4) as possible, consistent with the facts. Our initial motivation for relaxing it at all was the existence of morphological properties of the type listed in (3). A natural move, therefore, is to propose that the only manipulations of Morphosyntactic Representations that are available to syntactic rules are those that are required to accommodate those facts. These seem to consist of the possibilities in (9).

(9) a. Rules sensitive to structural form can assign configurational properties ((3a) above).

b. Other structure-sensitive principles may distribute the properties of a constituent to its members: for instance, a rule may assign the case of NP to the head of NP (the N), or to all of its members (head and non-head alike). This is the case of (3c) above.

Actually, the notion that lexical insertion takes place at D-structure rather than S-structure is characterized by Chomsky (1981: 92) as merely a "matter of execution," rather than an important principle of the architecture of grammars. As Chomsky notes, other authors (including Otero 1976; den Besten 1976; and Fiengo 1980) have proposed that S-structure is the appropriate level for the insertion of concrete lexical material, as argued here.
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c. Agreement rules can assign features to an item in order to cause it to agree with another (usually, but not always, a matter of feature copying).
d. The inherent properties of lexical items in a given language may be base-generated in association with nodes of various types (as suggested by Chomsky [1965]).

Among the operations that do not seem to be instantiated in natural languages are cases in which some property is deleted from an MSR by a principle of the syntax, or in which syntactic principles reorder or otherwise manipulate the representation's actual internal organization (which, as we will see below, is rather minimal in any event). If the range of possibilities in (9) is indeed exhaustive, that suggests the following constraint:

\[(10) \text{Monotonicity: The only effect a syntactic principle can have on a MSR is to add features to it.}\]

The combination of the principles (8) and (10) is, then, the form taken by the Lexicalist Hypothesis on the view being developed here. In the following subsection, we explore the kinds of information that must be assumed to be present in Morphosyntactic Representations.

4.2.3 The structure of Morphosyntactic Representations

Having concluded that the Morphosyntactic Representation of an inflected word must contain the information necessary to allow the construction of a correctly inflected form to interpret a particular position in a Phrase Marker, the next issue is that of the amount of structure we ought to attribute to these representations. The minimal (and thus the most desirable) theory of MSRs from this point of view is one that would assign them no internal structure at all. This is essentially the view proposed in Chomsky 1965, where the terminal nodes of Phrase Markers are assumed to be Complex Symbols that consist of an internally unstructured bundle of features.

However desirable, this view is probably too strong. In a number of languages, we find facts suggesting that some further information must be

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17 Notice that, in order to do this, the rules (or principles of the base) that are involved need only know what possibilities exist in a particular language, where these can be projected from the language's lexicon in a fashion independent of individual items. In particular, the rules do not need to know anything about the specific lexical items that instantiate those possibilities. Thus, if the lexicon of a language contains Nouns belonging to three arbitrary gender classes, and admits two numbers (singular and plural) for Nouns, the principles of the base can freely instantiate features such as [+ Feminine], [+ Plural] in terminal nodes with the feature [+ Noun] (or whatever represents this lexical class) without regard to the actual lexical items that will interpret the given position in Phonetic Form. Of course, it is a property of the distribution of these features in the base that combinations such as [+ Feminine, + Neuter] may be blocked, but again this can be projected from the lexicon without invoking specific lexical items in base structures.
present in MSRs beyond merely a collection of morphosyntactic features like [+Masculine], [3sg], etc. For instance, in many languages Verbs may agree with more than one argument in the same features (e.g. Subject and one or more Objects); or Nouns may bear both their own and their possessor’s features for number, person, obviation, etc. In these cases, we need a way to keep the two (or more) sets of specification distinct. Thus, Georgian *mo-m-klav-s “he will kill me” is not at all the same thing as *mo-v-klav “I will kill him”: both involve a [3sg] and a [1sg] actant, but obviously we need to know who is doing what to whom in order to produce (or on an alternative view, to select) the appropriate form of the Verb.

One possibility would be to recognize multiple, separate sets of features referring to the same property, but differing according to the syntactic source of that property. On that approach, we would have not just a single feature [+1sg], for instance, but rather [±1sg-Obj], [±1sg-Sbj], etc. Each of these would be treated as an atomic, internally unanalyzed feature that could be combined with other such features without fear of confounding the syntactic structures that gave rise to them.

An indication that this is not the correct approach is the existence of rules that generalize over the same features in more than one position. The Algonquian languages, for example, tend to have a set of prefixes /n-/ “first-person participant,” /k-/ “second-person participant” which are assigned to inflected words without regard to the role played by that participant. Verb forms meaning “you saw him” and “he saw you” would both be prefixed with /k-/, despite the fact that the second-person participant involved is Subject in one case and Object in the other. One might take this as evidence for the internally unstructured nature of the feature bundles making up MSRs in such a language, since just such a conflation would be predicted on that proposal. This will not suffice, however, since other parts of the morphology of an Algonquian Verb require information about which role (Subject or Object) was filled by the second person and which by the third person.18 Another example is that of the Georgian suffix /-t/ “plural participant,” which marks a Verb for the plurality of some one of its arguments without regard to role, though other more specific rules may block this where they exist. Again, while this aspect of the morphology conflates the possible sources of a feature, other aspects of the inflection of the same Verbs require that these sources be kept apart.

Another approach to this problem would be to recognize only a single set of features, but assign a limited amount of internal structure to the MSR

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18 See Hockett 1966 for further discussion of the nature of these inflectional systems in Algonquian.
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itself so that differences in the source of a particular feature specification can be reflected in the appearance of a feature in one position rather than another. To be concrete, let us suppose that a MSR can contain multiple structural 'layers,' in the sense that some of the elements on the (unordered) list of features composing a Morphosyntactic Representation can themselves be lists. The use of this 'layering' structure in the specific case of verbal agreement with two arguments (Sbj. and Obj.) is illustrated by the representations in (11).

(11) a. Transitive MSR: [Tense, etc., F_i, F^j] (where, for instance, the values F_i might come from the Subject, and F^j from the Object)
   b. Intransitive MSR: [Tense etc., F_i]

Of course, we must establish a principle by which representations of this sort can be constructed with a minimum of language-particular stipulation. Let us therefore propose the convention in (12).

(12) **Layering:** When a rule assigns features from a paradigmatic dimension to a MSR that already contains values on that dimension, the original values are treated as a list item hierarchically subordinate to the new values.

The layering effected by convention (12) is in fact the only kind of internal structure assigned to MSRs beyond that of an unordered list.

On this assumption, the representations in (11) would arise as follows. The language in question must employ agreement both with Subjects and with Objects. In the intransitive case, of course, nothing is required beyond the copying of features from the Subject position onto the Verb's MSR. In the transitive case, assume that Object agreement precedes Subject agreement. The application of Object agreement will result in a partial MSR, structurally similar to the intransitive case, but with the Object features [F^j] as the only agreement material. When Subject agreement subsequently applies, however, it will attempt to assign the features F_i to this representation, which is already specified for features from the same set. Layering (convention (12)) governs the result of this conflict, and subordinates the old (Object) values F^j as a list co-ordinate with the (Subject) values, yielding the representation in (11a).

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19 The notion of a 'paradigmatic dimension' needs to be clarified. The intuition here is that some feature values constitute a unitary cluster corresponding to a single dimension, such that a given form can have at most one value from within such a cluster. Thus, for instance, even if a language distinguishes a number of nominal Cases by means of some set of features, the parameter of 'Case' constitutes a single dimension of the paradigms of Nouns, orthogonal to other dimensions such as 'Number,' 'Possessor Person,' etc. We will assume below that in specific instances it is clear which features should be grouped together and treated as unitary paradigmatic dimensions, though a principled theory of such choices needs to be presented to fill out the position here. Much valuable discussion of these issues is to be found in Carstairs 1986.

20 We will see some evidence in support of this ordering relation between the Object and Subject agreement rules immediately below.
An exactly similar method could be used to represent the presence, in a language like Potawatomi or Finnish, of nominal inflection for the person and number of a possessor. In such a language, the Noun must obviously bear its own features (for number, gender, person, etc.) so that these can appear in agreement; as well as so they can be marked where appropriate. However, we do not want these feature specifications to be confused with those of the possessor. Now the striking thing is that, in many languages, there are structural parallels between the marking of possessors and the inflection of transitive Verbs. These are especially close in Potawatomi, as illustrated in (13).

(13)  a. /w-waputan-n/ “he sees them [inan.]” vs. /w-waputana-wa/ “they see it”
[\text{F}_{\text{sub}] [\text{F}_{\text{obj}]}

b. /w-čiman+m-n/ “his canoes” vs. /w-čiman+m+wa/ “their canoe”
[\text{F}_{\text{poss}] [\text{F}_{\text{noun}]}

Observe, in particular, that it is the properties of the Object of a transitive Verb that are structurally analogous to those of the Noun itself, while those of the transitive Subject are similar to those of the possessor of a Noun. We therefore want the representations of these two structures to be similar in that regard, and not merely in the features employed. In the construction of the representation of the possessed Noun, the features of the Noun itself, being inherent, are surely assigned to the representation first, and the features of the possessor are only added subsequently. From this we deduce that an analogous ordering ought to obtain among the rules of verbal agreement: Object agreement ought to precede Subject agreement, as indeed we assumed above.

We might, of course, treat the ordering relation just established for Potawatomi as an idiosyncratic property of that language. We have no reason to believe that such orderings differ from language to language, however, and it would obviously be preferable to limit the degree of freedom in individual grammars by imposing such orderings in the form of principles of linguistic theory.

In fact, there is a reasonably natural way to achieve this result. It seems plausible to suggest that the argument positions with which Verbs agree in natural languages are in general related structurally to it in different ways: the Direct Object is the sister of the Verb within a single constituent; an Indirect Object, if present, is sister to this constituent at the next level of structure; and the Subject position is sister to the entire VP within S. Roughly,

\footnote{See Hockett 1948, Anderson 1977c, and chapter 6 below for further information on the morphology of this language.}
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ignoring questions of precise constituent type and linear order, the structure in figure 4.1 seems to have considerable generality.

Observe that the argument position from which agreement should evidently operate first is structurally nearer to the Verb. As we will see in chapter 6, Georgian is a language in which agreement must operate from all three of the Direct Object, the Indirect Object, and the Subject position, in that order; and this suggests that the generalization we want about the sequence of agreement rules is essentially that given in (14).

(14) Agreement of a given item with elements in more than one position proceeds cyclically, with the structurally innermost elements triggering agreement before those that are structurally less close to the agreeing item.

The layered representations that we have invoked above will be correctly (and uniquely) constructed as a result of the combination of the principle in (14) with the others above, especially the layering convention (12). Notice that this applies not only to agreement of Verbs with various of their arguments, where it results in an organization that is similar to that of various 'thematic hierarchies' that have been discussed in the syntactic literature, but also to other cases such as that of possessed Nouns.22

An alternative to the layering proposal we have just described has been proposed by Zwicky (1986a). In order to represent agreement of the same element with more than one item characterized for the same features, this account invokes a notion of 'tagged features' instead of layers. The resulting representations appear as in (15), parallel to those in (11) above.

(15) a. Transitive MSR: [ Tense, etc., Sbj: F_i, Obj: F_j ]
   b. Intransitive MSR: [ Tense, etc., Sbj: F_i ]

22 We will see in chapter 6 below that rules internal to the morphology may have the effect of restructuring a MSR so that its internal organization no longer faithfully mirrors notions such as that of a thematic hierarchy. Since such rules are not part of the syntax, of course, they do not violate monotonicity (10), but they do indicate that the degree of internal organization inherent in layered representations cannot be dispensed with in favor of an appeal to some independent substantive defined notion, even if this could be extended to relations such as that between Nouns and their possessors.
The resulting structures retain the desirable characteristic of being unordered, unstructured lists, but at the cost of adding internal structure to the features themselves.

A problem for this proposal is the fact that the ‘tags’ it must invoke, in order to yield features that fall together into the right natural classes, are not always ones that might make sense in terms of grammatical sources of the features involved. More concretely, it is sometimes the case that there is no single set of tags that will suffice for all of the inflectional rules to be found within a given language. To see this, we must go beyond languages of the most familiar type, where agreement principles treat structurally unitary categories like “Subject,” “Direct Object,” etc., as morphologically natural categories as well.

In languages whose morphology is of the ‘ergative’ type, we find rules that assign the same morphological significance to arguments in the position of intransitive Subject or transitive Object – a class often referred to as the “absolutive” – and a different significance to transitive Subjects (or “ergative” NPs). Now in languages of the Northwest Caucasian family\(^{23}\) like Abkhaz, for example, the morphology of the Verb involves one set of rules that apply to mark agreement with ergative NPs, another for absolutives, and another for oblique complements such as the Indirect Object. In order to describe such facts in a unitary fashion, the ‘tagged-features’ proposal would have to say that instead of ‘Subject’ and ‘Object,’ such a language makes use of ‘absolutive’ and ‘ergative’ as tags.

However, this proposal immediately runs up against the fact that, in some languages, the same word may simultaneously show agreement of the Subject/Object sort and of the absolutive/ergative sort. Consider the verbal-agreement system in Kubachi Dargwa (Magometov 1976), as illustrated in tables 4.5 and 4.6. In these forms we see that Kubachi Dargwa has two distinct kinds of agreement: a class marker (/w/, /d/, /b/, or /j/), prefixed to the verb in the transitive forms in table 4.5 and suffixed to the intransitive forms in table 4.6, that agrees with the absolutive NP; and a suffixed marker which depends on the tense, and agrees with the Subject NP in person and number. The point is that a representation like that in (15) must make use of one set of tags or the other, but not both, which makes it difficult to provide a natural account of a system like that of Dargwa where the two sorts of reference are necessary at the same time.\(^{24}\)

A representation like that in (11), on the other hand, allows us to treat these as simply two different rules that happen to look at different aspects of

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\(^{23}\) See Dumézil 1975 for what is effectively a comparative grammar of the languages of this family, at least with respect to their morphology.

\(^{24}\) Similar facts are described for the Northeast Caucasian language Tabassaran in Harris 1987.
Table 4.5  *Dargwa transitive verb* iddi id gap wāq’aj "he praised him"

<table>
<thead>
<tr>
<th>Subject</th>
<th>Object class</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>3sg. Male</td>
</tr>
<tr>
<td>1sg.</td>
<td>w-āq’a-d</td>
</tr>
<tr>
<td>2sg.</td>
<td>w-āq’a-te</td>
</tr>
<tr>
<td>3sg.</td>
<td>w-āq’aj</td>
</tr>
</tbody>
</table>

Table 4.6  *Dargwa intransitive verb* id liw "he is"

<table>
<thead>
<tr>
<th>Subject</th>
<th>Subject class</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Male</td>
</tr>
<tr>
<td>1sg.</td>
<td>li-w-da</td>
</tr>
<tr>
<td>2sg.</td>
<td>li-w-de</td>
</tr>
<tr>
<td>3sg.</td>
<td>li-w</td>
</tr>
</tbody>
</table>

the same representation. A rule referring to the *absolutive* NP analyzes the innermost level of a MSR (whichever that may be); a rule referring to the *nominative* NP analyzes the outermost layer. Rules referring to the *ergative* or the *accusative* NP, on the other hand, must make specific reference to both layers. Note that agreement with an ergative or accusative NP is substantially less common than agreement with absolutive or nominative, and virtually never occurs in the absence of the latter type. On the other hand, the same word may show simultaneously absolutive and nominative agreement, as in the Dargwa examples above. These facts suggest that layered representations such as those in (11) provide a more general solution to the problem of multiple-agreement feature sets than do the tagged representations in (15).

In fact, consideration of the types of reference to features in a multilayered MSR that seem to occur in natural languages suggests that essentially all of the possibilities naturally provided by representations like those in (11) are actually employed in one language or another. This suggests that a theory of morphology should provide a notation for such reference that makes these different sorts of access to the featural content of a representation explicit. Anticipating some of the points of chapter 5, we assume that the Word Formation Rules that realize inflectional material can refer to the features
contained in a word's morphology in any of the ways in (16) in the form indicated.

\[ (16) \]

**Specific reference:** e.g., \([+F [-F]]\) (applies only if \([+F]\) in outer layer and \([-F]\) in inner layer).\(^{25}\)

**Outermost layer** reference: \([+F (X)]\) (applies when outermost layer contains \([+F]\), regardless of what – if anything – is contained in subordinate layers).

**Innermost layer** reference: \([+F]\) (by convention, analyzes only the most deeply embedded level of list structure for the value \([+F]\)).

**Anywhere** reference: \(+F\) (when no bracketing is specified, analyzes any representation containing the value \(+F\) at any level).

This set of "access functions" for referring to the content of MSRs may seem to be simply an enumeration of the possibilities provided by a full set of boolean conditions on analyzability, but that is not quite the case. For instance, the functions in (16) provide no way of specifying directly a reference to the features of precisely an *intransitive* Subject. A set of rules might well introduce some marker that corresponded only to intransitive Subjects, but the only way to achieve this effect would be to have two rules: one that applies to all Subjects, and another which applies precisely to transitive Subjects. As we will see in chapter 5, the principles of disjunctive ordering within rule systems could have the effect of blocking the application of the general Subject rule in those cases where the (more specific) transitive Subject rule is applicable, effectively limiting it to marking intransitive Subjects. The empirical prediction that results from this is that no language will have a rule applicable only to intransitive Subjects unless it *also* has a rule marking specifically transitive ones. In fact, the use of boolean operators to relate separate conditions is quite constrained if the cases enumerated in (16) indeed exhaust the possibilities employed in natural language. It would of course be desirable to have some explanation for why just these cases are found, and not others, but we leave that as a problem for future research.

Of the types of reference to MSRs listed in (16), we have already discussed the first three above, and we will see further explicit examples in chapter 6. The last possibility is illustrated by the prefixed first- and second-person markers in Algonquian languages such as Potawatomi, which we have already had occasion to refer to above. Another case of this sort is furnished by Gyarong, a Tibeto-Burman language (see DeLancey 1987). In this language,

\[^{25}\] Specific reference is not limited to cases in which only two layers of structure are called for. In languages such as Georgian, where MSRs can have three layers in the case of a Verb with both Direct and Indirect Object agreement, some rules of the morphology may need to refer to all three. See the discussion of Georgian in chapter 6 for further illustration.
a third-person NP that is the Subject of a transitive Verb is marked for Case as ergative. The Verb itself is marked for a first- or second-person argument, regardless of that argument’s role. Finally, when the Object is ‘higher’ on a hierarchy of person than the Subject, another marker (glosed “DIR”) appears as an indication of that fact.

(17) a. ɳa  mə  nasņo-ŋ
    I   s/he  scold-lSG
    “I scold him/her”

  b. ɳə-ŋjo  mə  nasņo-č
    I-DU   s/he  scold-lDU
    “We two scold him/her”

  c. ɳə-ńiie  mə  nasņo-i
    I-pl   s/he  scold-lPL
    “We (pl.) scold him/her”

  d. mə-ka  ɳa  u-nasņo-ŋ
    s/he-ERG I  DIR-scold-lSG
    “S/he scolds me”

  e. ɳə-ńiie-ka  ɳa  u-nasņo-ŋ
    s/he-DU-ERG I  DIR-scold-lSG
    “They two scold me”

  f. mə-ka  ɳə-ŋjo  u-nasņo-č
    s/he-ERG I-DU  DIR-scold-lDU
    “S/he scolds us two”

Rules that introduce the markers /-ŋ/ “first-person singular,” /-č/ “first-person dual,” and /-i/ “first-person plural” in Gyarong (as well as corresponding second-person markers) refer simply to the presence of the relevant features in the Morphosyntactic Representation of the Verb, without regard to the precise structural position in which the features concerned are to be found. This suggests that the ‘layering’ proposal provides no more structure than is needed, but, as far as can be told, it provides enough. We will therefore assume that layered feature bundles constitute a plausible theory of the internal structure of Morphosyntactic Representations.

4.3 Conclusion

In this chapter, we considered the traditional distinction between inflectional morphology and other types, including derivation and compounding. We saw that there is probably some reason to take these differences seriously, despite the fact that none of the traditional attempts to define inflection as opposed to other areas of word structure seem to be completely satisfactory. In
surveying the types of morphology that fall under the intuitive notion of inflection, we saw that these all have the property of involving an interaction between word formation and syntactic principles, contrary to the strongest form of the Lexicalist Hypothesis ((4) above). We therefore took this characteristic as potentially definitional: inflectional morphology is the area in which principles of syntactic structure and of word formation interact with one another, and a theory of inflection is in some sense a theory of the ways in which the maximally strong form of the Lexicalist Hypotheses must be relaxed.

In the final section, we addressed the nature of the informational interface between syntax and word formation. Since it appears that an analysis of words into their constituent stems and affixes does not have the right form to serve as the representation which is common to these two areas of grammar, we investigated the nature and structure of the Morphosyntactic Representations which serve on the one hand as the terminal nodes of syntactic Phrase Markers, and on the other as representations of the inflectional properties of words. We have argued that these have a limited amount of internal structure, but in general have the character of an unordered list similar to the Complex Symbols that served essentially the same purpose in Chomsky 1965. They thus avoid the problem of providing information that is systematically irrelevant to the interaction of syntax and morphology (which we argued would be the case if we took a direct analysis of the form of words as the informational interface between these two domains). On the other hand, since they contain all (and only) the features relevant to this interaction, they do not require us to posit otherwise unmotivated formal constituents when a category is marked in a non-affixal fashion (or not marked at all) in some words, another difficulty for the view that the formal analysis of words provides the communication between morphology and syntax.

Once we recognize that the formal morphological structure of words is distinct from the Morphosyntactic Representations, it follows that the best way to treat the latter is as lists with as little internal structure as possible (and no internal order) among their constituents. The reason for this is that such an unordered list provides the least possible information, consistent with the task it must perform. It thus constitutes the (formally) weakest theory of this part of grammar, and correspondingly yields the strongest form of the Lexicalist Hypothesis consistent with the facts.

In the next chapter, we go on to consider some further aspects of the theory of inflection. We will see there that much of the substantive content of this domain actually falls under other, established principles of the theory of syntax.
5 The theory of inflection

In chapter 4 we discussed some reasons to believe that 'inflection' is a domain of grammar in which morphological and syntactic considerations overlap to a significant extent. In section 4.2 of that chapter, we dealt with one central aspect of a theory of that domain: the content and nature of Morphosyntactic Representations. The point of that exercise was not simply to develop a (possibly obscure) formalism, but rather to explore just exactly what information exists in the interface between syntax and word structure. We saw that this can be reduced to an unordered list of inflectional properties (or 'morphosyntactic features'), with a minimum of internal structure. A limited internal organization of this information, beyond that of an unordered inventory of properties, is necessary to deal with cases where a single word bears more than one specification for the same dimension. To accommodate these, we proposed the device of 'layered' representations (essentially, the hierarchical subordination of some unordered feature sets to others), together with a general convention on how these are created and a restricted set of ways in which their content can be referred to in specific rules.

Recall that in chapter 4 we found a number of substantive areas where morphological properties of words appear to be determined by an interaction with the syntactic environments in which they appear; or of properties that must be visible to syntactic principles for these to perform their intended function. In order to account for the distribution and formal reflection of these properties, a theory of inflection must provide explicit accounts of at least these other areas (in addition to the theory of Morphosyntactic Representations). The present chapter considers a number of other aspects of a theory of inflection which are motivated by those considerations.

In section 5.1, we develop the outlines of a theory of agreement. We consider two subcases of agreement, that between modifiers and their heads, and between predicates and their arguments. We then go on to discuss in section 5.2 the principles underlying the configurational assignment of properties to phrases, and the kind of rules that perform such assignments. Properties assigned to phrasal categories, whether through the operation of such configurational rules or through the mechanisms implicated in the account
of agreement offered here, may be realized through the morphological characteristics of particular words within a phrase, and so a theory of **phrasal property realization** is involved in both of these domains. In section 5.3 we discuss the organization of the rule system that provides the **phonological realization** of morphological properties. Basic proposals for the internal organization of this rule system are laid out in subsection 5.3.1; one particularly important aspect, the principle(s) of **Disjunctive Ordering** among morphological rules, is surveyed in section 5.3.2.

The purpose of the present discussion of subareas within a theory of inflection is not to develop a comprehensive account of any one of them. Rather, our goal is to show the lines along which the substantive parts of such a theory can be filled in, consistent with the general program under investigation in this book. Much further work remains to be done in each area, but the general nature of the problems to be resolved seems reasonably clear. A goal of the discussion here is to show that in general, the relation between morphology and syntax that defines ‘inflection’ falls into well-defined places within existing theories of grammar. By and large, we will see that the factors which are operative within each subpart of the theory of inflection do not constitute completely new kinds of problem, but are, rather, particular instances of established grammatical principles, even if the implications of these principles for inflection have not always been made fully explicit in previous work.

### 5.1 Agreement

We begin by considering the content of a theory of agreement. The first question to pose here is, of course, that of the nature of the phenomenon: just what is ‘agreement’ (or as it is often called in the traditional literature, “concord”)? Just as in the case of inflection itself, this is a quite intuitive notion which is nonetheless surprisingly difficult to delimit with precision. Indeed, after an extensive survey of a wide range of facts and theories, a recent volume devoted entirely to this topic concludes that “no consensus has been reached on the limits to be set on what constitutes grammatical agreement or on the basic parameters in terms of which agreement phenomena can or should be characterized” (Barlow and Ferguson 1988: 3).

A maximally inclusive approach would be to treat any case in which “the formal category of one word depends on that of another” as an instance of agreement. This is surely too permissive, however. To see this, consider the

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1 Another possible realization of these phrasal properties is through the mechanism introducing so-called ‘special clitics,’ which will form the subject matter of chapter 8 below.
fact that the form of case marking in a Georgian sentence depends on the
tense of its main Verb. This tense can come from one of three distinct sets,²
where each induces a particular pattern of marking for the Subject and Direct
Object arguments³ as illustrated in (1).

(1)  
**Future:** ivane (nom.) vanos (dat.) moklavs “John will kill Vano”
**Aorist:** ivanem (erg.) vano (nom.) mokla “John killed Vano”
**“Perfect”:** (turme) ivanes (dat.) vano (nom.) mouklavs “(Apparently,)
John killed Vano”

In such a case, we surely would not want to say that Georgian NPs ‘agree’
with their Verb in tense,⁴ though the formal category of case in NPs does
indeed depend on that of tense in Verbs. The reason for this reluctance,
presumably, is the sense that agreement must involve a dependency of some
category in an agreeing element with the *same* category in some other element.

We might thus attempt to describe agreement as a state of affairs in “which
a grammatical element X matches a grammatical element Y in property Z
within some grammatical configuration” (Barlow and Ferguson 1988: 1). But
again, as these authors observe by implication, this definition cannot be taken
entirely literally, since it leaves unresolved what it means for one element to
‘match’ another in some property. For example, in the French sentences in
(2) the adjective is masculine in one case and feminine in the other, despite
the fact that the only element it could possibly agree with, the Subject pronoun
*je*, is not marked for gender.

(2)  
*Jean:* Ah, comme je suis heureux d’être encore une fois chez toi!
*Marie:* Je le sais. Mais, moi, j’en suis encore plus heureuse que toi!

Indeed, there are circumstances in English where the apparent formal status
of a Noun Phrase with respect to the category of number is not the same as
that of an ‘agreeing’ Verb.⁵

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² These are the “present/future” series, the “aorist” series, and the “perfect” series. See chapter 6 for discussion.
³ There is also a difference in the marking of Indirect Objects, which appear in the ‘dative’
with present/future series tenses, but as oblique Postpositional Phrases with ‘perfect’ series
tenses.
⁴ Indeed, if the “Control Agreement Principle” of Generalized Phrase Structure Grammar
(see Gazdar et al. 1985) is correct, and agreement is only possible from arguments to
functors and not *vice versa*, agreement of this sort would be excluded in principle. The
sort of directional asymmetry posited in the Control Agreement Principle is precisely the
sort of effect that is straightforward to associate with the operation of a rule, but much
harder to enforce as a constraint on distribution. See below.
⁵ The examples here are cited from Quirk *et al.* 1985, which contains an extensive discussion
of peculiarities in English Subject–Verb agreement. Other discussions of English agreement
facts that are problematic, at least for any straightforward, distributional statement of
the regularities, include Morgan 1984 and Martin 1987 among others.
5.1 Agreement 105

(3)  
   a. Danish bacon and eggs makes a good solid English breakfast.  
   b. Sixty people means a huge party.  
   c. American and Dutch beer are much lighter than British beer.  
   d. Beer from America and Holland is much lighter than British beer.  
   e. The public have a right to know.  
   f. (British English:) England have won the cup.

Notice that in expressions such as (British English) The crowd have rejected  
the government's notion of wage parity, it will not do to treat crowd as a sort  
of pluralia tantum Noun that happens not to end in -s, parallel to, for example,  
people. This is because it can perfectly well be pluralized (as in Great crowds  
have gathered at all of the ministries) and can also take singular agreement,  
with a subtle difference of sense (as in The crowd has been dispersed).

The above remarks certainly are not intended to deny that there are  
substantial and quite general regularities of agreement in languages like French  
and English (though there do seem to be circumstances for which no agreement  
form seems correct, such as Either my wife or I *am/*is/*are going). However,  
the nature of these regularities does not seem to be captured by definitions  
of the sort we have considered thus far.

The problem with those definitions, we claim, is that they attempt to identify  
grammatical agreement with a configurational constraint on the distribution  
of features: one structural position \( P_1 \) agrees with another position \( P_2 \) in  
feature [F] when the value of [F] at \( P_1 \) is the same as the value of [F] at \( P_2 \)  
(or in the more permissive case, the value of [F] covaries with the value of  
some feature [G] at \( P_2 \), where [G] may or may not be the same as [F]). Of  
course, it might be possible to define agreement to be a constraint on the  
distribution of features in one position as a function of those present at some  
other position, but such definitions do not seem easy to formulate.

Recall that, in response to various problems discussed in chapter 4, we  
proposed to define 'inflection' in terms of the structure of a grammar rather  
than independently: we took inflection to be just the morphology that is  
accessible to and/or manipulated by the rules of the syntax. We might well  
approach agreement in a similar way: we might assume that rather than  
reflecting a distributional regularity in the surface forms of sentences, as often  
assumed, 'agreement' reflects the operation of a grammatical rule of a certain  
sort; or alternatively:

(4)  
   'Agreement' is what is produced by the operation of an agreement rule.

As it stands, obviously, such a "definition" is somewhat less than helpful;  
but if we can give concrete substance to the rules that are to count as agreement  
rules it may well prove more successful than other proposals in the literature.

There is a general point to be made here about the nature of grammatical
notions. We often approach such terms as if we could give an independent, pretheoretic definition of notions like 'inflection,' 'agreement,' and others; and then reconstruct or further explicate them in the course of articulating a theory of grammatical structure. But if the theory really does what it should, and provides us with a framework for bringing order and coherence to a domain of facts, it may well be the case that the coherence of the relevant grammatical notions lies precisely in the role they play in that theory, and not in some pretheoretic grounding which we can provide. If the theory really is a correct theory of some area of grammatical structure, that is, it may be the case that certain notions that are quite intuitive have their only full explication within that theory. Proposed definitions such as (4), then, are not so much circular as they are programmatic: they propose that grammatical theory will involve some substantive notions such as 'agreement rule(s)' which will themselves constitute a definition of the phenomenon in question.

Of course, a comprehensive account of agreement would require a book in itself (as attested by the several books that have already been devoted to this topic), and we cannot hope to provide that here. In the following subsections, we attempt only to outline the main properties of agreement systems. We will argue that the characteristics of agreement rules place them within the bounds of known types of syntactic organization, and thus that their operation should be consistent with known constraints and principles in their respective areas rather than constituting an entirely novel domain of grammatical structure.

In intuitive terms, it seems natural to distinguish between two sorts of agreement: that between modifiers and the heads of their phrases; and that between 'predicates' (including V, Adj, Prep, and possessed N) and their arguments. These are dealt with separately below.

5.1.1 Modifier–head agreement

The canonical example of this sort is agreement of Adjectives with a Noun they modify in terms of such properties as case, gender, and number. Consider the Direct Object NP in the Sanskrit sentence in (5).

(5) ramanîyâni vanâni sobhanaîm jalâm ca paśyāmi
   pleasant-N.ACC.PL forest(N)-ACC.PL shining-M.ACC.SG water(M)-ACC.SG and I-see
"I see pleasant forests and shining water"

In the subpart of this Noun Phrase ramanîyâni vanâni "pleasant forests (acc.)," we find the Adjective ramanîyâni "pleasant" agreeing with the Noun vanâni

* See Anderson (1985a: sec. 2) for a survey of agreement properties to be found in various word classes in the languages of the world.
5.1 Agreement

"forests" in case (accusative), number (plural) and gender (neuter). In asking how this agreement takes place within the grammar of Sanskrit, we should first note that these three properties in the Noun itself have rather different sources.

The fact that the Noun is in the accusative case is not in fact directly a property of the Noun, but rather a reflection of the fact that it is the head of a Noun Phrase which is (a conjoined subpart of) the Direct Object of the verb *paśyāmi* "I see." Presumably (and as will be discussed further in section 5.2 below), a rule of the grammar assigns a feature such as [+Accusative] to the entire Direct Object. We must then posit principles which allow this features to be ‘inherited’ by each of the two conjoined NPs that the Direct Object contains; and then further inherited, within each of the conjuncts, by the Noun which heads that NP.

The notion of feature ‘inheritance’ invoked here is one which is assumed in principle within essentially all syntactic theories, though often without explicit discussion. The most extensive analysis of the relevant ideas seems to be provided by the similar (but not necessarily identical) principles governing feature transmission and agreement within Generalized Phrase Structure Grammar (GPSG: see Gazdar et al. 1985). This is the theoretical perspective from which the most specific proposals about formalisms for feature transmission have been made, although similar mechanisms are assumed by other theories.

Within this general framework, we say that the property of ‘case’ in Sanskrit is an instance of what would be called within GPSG a HEAD feature. Such features have the property that phrasal categories and their heads must agree in them, and so the assignment of such a property to a NP results in its transmission by convention to the head Noun of that NP.

The status of the properties of ‘gender’ and ‘number’ are quite different in important respects. Clearly, the fact that the Noun *vanāni* "forests" is neuter does not derive from its syntactic environment (as its case does), but is, rather, a lexical fact about the word *vanam* "forest." This is an inherent feature of the Noun, which must be accessible to whatever rules or principles enforce agreement in this case. The fact that *vanāni* is plural, on the other hand, does not derive either from the external syntactic environment in which the phrase appears (like case) or from a lexical characteristic of the Noun (like gender).

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7 Note that here and elsewhere below, unless explicitly indicated otherwise, ‘case’ refers to the actual morphological property of Nouns and Adjectives, not to the (possibly related, but not identical) notion of ‘abstract Case’ invoked in much of the recent literature within the theory of Government and Binding.

8 More recent versions of this general perspective, sharing most of the properties of interest here, include ‘Head-driven Phrase structure Grammar.’ See Pollard and Sag (1987) for discussion.
The theory of inflection

It is, rather, a property of Nouns (and derivatively, of Noun Phrases) in Sanskrit for which they must be marked directly. In Chomsky 1965 such properties are described by allowing the rules of the base to introduce feature values such as $[\pm\text{Plural}]$ into the Complex Symbols that constitute the terminal nodes of Phrase Markers, corresponding here to the Morphosyntactic Representations introduced in chapter 4 to fill the same function.

We assume, therefore, that values for the features of number and gender are introduced into the Morphosyntactic Representations of Nouns in Sanskrit by the rules of the base. In the case of gender, the choice of a particular value has the effect of constraining the range of lexical items that can possibly interpret a given position: thus, a representation containing the value $[\text{Neuter}]$ can only be interpreted by a Noun that bears the same feature lexically. Since most Nouns (apart from pluralia tantum words, like English trousers, and other paradigmatically defective types) do not bear any lexical specification for number, the appearance of a feature like $[\pm\text{Plural}]$ does not serve to constrain lexical choice, but rather (like marking for case) to ensure that once chosen, a given Noun will be properly inflected according to the principles of the language’s morphology.

Thus we see that the features that are operative in this instance of modifier-head agreement are all present in the Morphosyntactic Representation of the head Noun, though they derive from distinct sources (case by the inheritance of a HEAD feature assigned to the containing NP, gender and number introduced by the rules of the base). We could now treat the agreement itself as a matter of copying features from this Noun onto its associated modifiers. This is essentially the mechanism employed within GPSG, where the ‘Control Agreement Principle’ requires that some specified set of argument/functor pairs agree in certain features, as effected by copying those features from the arguments to the functors.

In fact, however, there is another way to ensure the same result, without invoking a copying rule directly. Suppose we say that gender and number, like case, are HEAD features in Sanskrit. In that event, the requirement that categories and their heads match for such features will operate in the opposite direction from that involved in transmitting the feature of case, so as to impose the values of gender and number found in the head Noun’s Morphosyntactic Representation on the NP itself. As a result, all of the

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* Notice that this proposal is quite independent of the issue of whether the rules of the base are, as has been proposed, simply projections of the properties of the lexicon of a given language. On that proposal, the fact that certain features are characterized as (something analogous to) HEAD features provides the information from which we can project their occurrence in Morphosyntactic Representations; and the principles governing that occurrence thus play the role of the ‘rules of the base’ referred to here.
agreeing features (gender, number, and case) will be found not only within the Morphosyntactic Representation of the head N, but also at the phrasal level.

The relevance of this move is the following. The theory of features within GPSG posits a class of \textit{foot} features in addition to (and not necessarily disjoint from) the class of \textit{head} features. These have the property that their values on non-head daughters of a phrasal category are transmitted to the phrasal category itself. Suppose that we now recognize a third type of required featural identity: for some set of \textit{dependent} features, the value assigned to the phrase itself is transmitted (by convention) to all of its daughters. In this way, the relevant features of agreement would be transmitted to non-head elements (such as Adjectives within NP) indirectly, through the properties of the NP, rather than directly from the head Noun.

There are certain advantages to the proposal of the preceding paragraphs over some existing treatments, though this is a matter of 'execution' rather than a 'leading idea' (in terms of a distinction often made in Chomsky's work). The goal of this discussion has been to point out that the basic mechanisms involved in ensuring that modifiers agree with their head are matters of ensuring that some sort of featural identity obtain between phrasal category nodes and certain designated constituents of those phrases (heads and non-heads). The precise content of the conditions of required identity are less important than the notion that some such conditions are what is at work in this type of agreement.

The structural relations that obtain among phrases, the heads of which they can be regarded as projections, and their non-head dependents is precisely the concern of the theory of base structures, or \textit{X-theory}. The relation

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10 Perhaps it is necessary to restrict such transmission to daughters not already specified for some value of the same feature. This would have the effect of requiring that all daughters be specified in some way for the feature; and that any failure of a daughter node to agree with its phrase in some \textit{dependent} feature be locally motivated in terms of the structure of the daughter node itself.

11 For example, it makes it natural for Adjective agreement in German to reflect not only the \textit{head} features of the Noun, but also the value of certain \textit{foot} features, such as the class of a preceding Determiner. If Determiner class as well as case, gender, and number are all \textit{dependent} features, they will all be available to determine the inflection of Adjectives after being cumulated in the head NP category. This problem is discussed in similar but slightly different terms in Zwicky 1986c.

12 Pullum (1985) points out that although the content of this component of a grammar is widely regarded as having been established, there is in fact less agreement on its actual substance than meets the eye. That is, a number of versions of \textit{X-theory} have been proposed in the literature which are not all mutually consistent, but which are often referred to interchangeably by syntacticians. Despite disagreements on many matters, however, there is also a substantial consensus on the general considerations appealed to here.
between the mechanisms employed in the account of agreement offered above and the core principles of X-theory is actually closer than might be imagined: we could suggest, for example, that the fundamental claim in all versions of the theory that phrases are projections of their heads is expressable as the requirement that lexical category be a HEAD feature. If the view of modifier–head agreement suggested here is correct in general, the consequence is that the principles of such agreement can appropriately be regarded as special cases of the principles governing the categorial structure of Phrase Markers – a well-established area of syntactic inquiry.

In addition to the principles that govern relations among features at various positions in a structure, there is another aspect of such agreement that requires some discussion. This is because the actual relation between a mother node’s features and those of its daughters is not simply a requirement of identity, but may involve ‘resolution rules’ (see Corbett 1986) and other local computations. The simplest case of this sort is the fact that conjoined singulars typically yield a NP which must bear the property [+ Plural] (with additional complications for languages with further categories of number). Since none of the daughters of such a NP in fact bears this feature, some sort of local computation seems to be needed in order to determine the correct relation between the features of such a co-ordinate phrase and those of its daughters.13

Various other morphological dimensions give rise to similar problems. We must, for example, provide for the predominance in co-ordinate structures of first over second over third person: thus, he + I = we, not they (a problem addressed by Sag et al. 1985). More dramatic, perhaps (because more idiosyncratic to the systems of individual languages) are the rules found in various grammars for the resolution of gender in conjoined structures. In Icelandic, for instance, the co-ordination of a masculine and a feminine Noun yields an NP which is grammatically neuter, rather than either masculine or feminine. In Slovenian (as pointed out in Corbett 1986), where the genders are masculine, feminine, and neuter, if all conjuncts are feminine, the result is feminine; but otherwise (even if no masculine NPs are involved – for example, when all conjuncts are neuter) the result of conjoining multiple NPs is masculine. Even more complex problems are presented by the highly structured principles, varying from language to language, that specify the case

13 Sag et al. (1985) discuss some problems of this sort within the framework of GPSG. It is not clear that their solution generalizes to a language with singular, dual, and plural numbers where “John” behaves as singular, “John and Mary” as dual, and both “John and his parents” and “John, Mary, and Fred” as plural. The problem of resolving the number of conjoined NPs in purely mechanical terms is likely to be even more severe in languages whose ‘dual’ number is in fact a ‘paucal,’ referring to “a few” rather than exactly two.
of various positions within Slavic NPs containing quantifiers (see Corbett 1986; Babby 1988). Such systems clearly involve some locally applicable, partially language-particular principles that perform limited sorts of computation over the values of a given featural dimension (number, gender, person, etc.).

The significance of such complexities, however, is not that the theory of modifier–head agreement falls outside the scope of the principles governing the categorial structure of Phrase Markers; it is, rather, that the notion of 'identity of features' which is relevant to that component may be more complex than is commonly assumed, and may involve some language-particular specification.

5.1.2 Predicate–argument agreement
Agreement of modifiers with their heads, and of predicates (e.g. Verbs) with their arguments (such as Subject and Object) are often grouped together as a unitary class of phenomena. The question of whether these correspond to the operation of a single mechanism naturally arises within any formal account of agreement.

The mechanisms which we suggested to account for modifier–head agreement in the previous subsection involved the passing of feature specifications within the structure of phrasal categories. Basically, the full categorial structure of the phrase itself comes to reflect all of the properties that are recorded on modifier elements within it, including properties assigned from its external context, properties of its head, and perhaps also (as in the case of the influence of German Determiners on adjectival agreement) some properties of non-head elements. These are accordingly assigned (by virtue of their designation as 'DEPENDENT' features) to the modifier elements.

In contrast, most descriptions of agreement between predicates and their arguments assume a mechanism by which features of the latter are copied directly onto the agreeing functor, rather than being passed up to a higher category and then inherited by another element within that category. The discussion below will generally adopt that mode of presentation, though it seems likely that a feature-inheritance mechanism similar to that involved in modifier–head agreement may actually be more appropriate. It has been noted (see Bayer 1984, Hoeksema 1986, and Bennis and Haegeman 1984 for some description and discussion), for example, that some German and Dutch dialects display (at least partial) agreement between the complementizer of an embedded clause and the Subject of that clause. This would be quite unusual as a form of agreement between predicates and arguments, since the Subject of a clause is hardly an 'argument' of the complementizer. On the other hand, if clause-internal Subject agreement involved the passing of
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agreement features from the Subject up to the S node, and their subsequent inheritance by the (inflected) Verb, we need only assume that in the dialects in question the agreement features are further passed from S up to the dominating S, where they are realized on the head of that category (the complementizer).

Similarly, a number of languages in New Guinea (see Foley 1986: 185ff., for a survey) display a kind of 'anticipatory agreement' in dependent clauses whose Subjects are different from those of the following clause. In the Fore example, (6) below, for instance, the first Verb kana "come" is marked not only for the person and number of its own Subject, but also for the person and number of the Subject of the following Verb ka "see":

(6) kana-a:-ki-tá a-ka-us-e
come-3SG.SBJ.PRES-DEP-1DL 3SG.OBJ-see-1DL.SBJ-DECL
He comes and we both see it"

In such systems, we could assume that the agreement features of Subjects are inherited not only by the Verb of the same clause, but also by embedded Ss, where they are in turn inherited by the embedded Verbs and realized as 'anticipatory agreement.' Here again it seems most natural to describe the mechanism of agreement as involving the passing of features between phrasal category nodes and their dependents.

There is some reason to believe, however, that agreement between predicates and their arguments\(^\text{14}\) also involves some properties that go beyond those characteristics of modifier-head agreement. In particular, agreement of this type seems to involve not only the copying of features (in this case, from the argument onto the predicate) but also the establishment of a relation of 'co-indexing' (sometimes called 'co-superscripting') between the agreement features and the argument that provides them.

A distinction similar to the one being made here has sometimes been referred to within the theory of Relational Grammar,\(^\text{15}\) where two sorts of 'agreement' have been discussed. One of these, called 'registration,' consists in marking an 'agreeing' element in some way so as to record the presence of another element with certain properties somewhere in the surrounding structure. Once

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\(^{14}\) This type includes agreement between possessed Nouns and their possessors as well. Again, see Anderson (1985a: sec. 2) for a survey.

\(^{15}\) Although the distinction between 'registration' and true agreement referred to here was discussed in Perlmutter and Postal's lectures at the 1974 Linguistic Institute (the locus classicus for many points in the theory of Relational Grammar), it does not seem to have made it into the published literature. This is unfortunate, since a coherent understanding of the nature of agreement per se must start by distinguishing it from superficially similar phenomena such as 'registration,' the relation between tense and case marking in Georgian cited above, etc.
that fact has been recorded, however, there is no reason to assume that any particular relation persists between the two elements involved as a concomitant of the registration relation. For example, consider a language in which transitive Verbs have some distinctive stem formative not found with intransitives. In this case, Verbs could be regarded as 'registering' the presence of a Direct Object NP, but not (necessarily) as 'agreeing' with it.

This notion seems quite similar to that involved in modifier–head agreement: once the appropriate features have been passed to a modifier element, there is no reason to believe that their marking on the modifier corresponds to the establishment of any other relation. The agreement marking of ramaṇiḥāṇi “pleasant” in (5) records the fact that it occurs in a neuter accusative plural NP. Of course, the semantic interpretation of such a NP involves a relation of predication, in which “pleasant” is predicated of “forests,” but there is no reason to believe that the morphological relation of agreement between ramaṇiḥāṇi and vaṇāṇi corresponds to some property that goes beyond this matter of registering the categorial features of the NP (of which vaṇāṇi “forests” is the head).

We can contrast this situation with what we find in agreement of the predicate–argument type. Here the syntactic literature within a variety of frameworks has been led to assume that a more complex relation is involved between the two terms that ‘agree.’ In particular, the agreement morphology itself has been widely assumed to have some of the same referential properties as explicit anaphoric elements16 such as pronouns. This function of agreement is in fact already involved in the assertion, common in traditional grammars, that in a Latin sentence such as veniō “(I) am coming,” the Subject of the sentence is represented not by an overt NP, but by the first-person singular agreement morphology on the Verb. For this to be a plausible account, it must be assumed that the agreement morphology itself has the capacity to refer, and presumably to co-refer with whatever NP gives rise to it, if that NP is structurally present.

It is well known that when two or more co-referring elements occur within the same structure, there are rather precise conditions on the structural relations that can (or must, or must not) obtain between pairs of such elements. These relations are the province of the ‘Binding conditions’ in a syntactic theory such as that of Government and Binding (or ‘Principles and

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16 The sense of ‘anaphoric’ here is the non-technical one of ‘referring back,’ rather than the more specific sense in which this word is often used in the contemporary syntactic literature, where it refers only to elements with the referential properties of reflexive or reciprocal pronouns, or certain types of empty categories. Of course, agreement may well be an element of this more limited sort, but we mean here only to evoke its general referential function.
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Parameters'), the context in which they have been most extensively studied. If the referential nature of agreement suggested above is correct, then, we would expect that (at least some of) the principles governing the relation between other sorts of co-refering elements would also apply to the relation between agreeing items and the arguments they agree with.

Indeed, just that assumption has been widely made in the syntactic literature, especially in connection with the conditions under which languages can allow structurally significant arguments to be omitted (or as this is usually put, represented by phonologically null forms). It is often said that when the agreement system of a language is "sufficiently rich," the presence of agreement sanctions the occurrence of phonologically null pronominal elements in the corresponding argument position(s). Indeed, just that assumption has been widely made in the syntactic literature, especially in connection with the conditions under which languages can allow structurally significant arguments to be omitted (or as this is usually put, represented by phonologically null forms). It is often said that when the agreement system of a language is "sufficiently rich," the presence of agreement sanctions the occurrence of phonologically null pronominal elements in the corresponding argument position(s).

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Usual discussions of this state of affairs are limited to phonologically null subjects, but languages like Georgian also show phonologically null Objects in a way that is probably related to the fact that Verbs agree with their Objects as well as their Subjects in this language (see Anderson 1984b and chapter 6 below). The same analysis is extended to agreement with possessors in Noun Phrases in Chamorro by Chung (1982). Exactly what constitutes a "sufficiently rich" agreement system is a matter of some controversy: at a descriptive level, overt morphological marking of a range of person and number distinctions is apparently neither necessary (cf. Chinese and Japanese) nor sufficient (cf. French) to allow phonologically null subject pronouns. Nonetheless, it seems clear that in at least some languages, some sort of co-indexation relation must be assumed between agreement material and the specific NPs that the relevant predicate agrees with. A similar relation is invoked, for very different reasons, in the account of Georgian case marking proposed in Anderson 1984b and chapter 6 below. We suggest, in fact that the appropriate notion of an agreement system which is "sufficiently rich" to support phonologically null arguments in certain positions may even be definable as one in which agreement material co-indexes (as opposed to merely registering) its associated arguments.

Further evidence for co-indexation in agreement includes phenomena which have been described as 'dis-agreement' rules in Abkhaz and elsewhere (see Anderson 1974a). These are cases in which the occurrence of overt agreement on a predicate is in complementary distribution with the appearance of a phonologically realized Noun Phrase in the agreeing position: thus, not only does the occurrence of the agreement sanction a Phonologically empty form,

17 This may simply be one instance of a general principle — the Empty Category Principle — sanctioning phonologically empty elements in positions where their reference can be recovered from that of a co-indexed element in a structurally appropriate position.

18 As Norbert Hornstein points out to me, the possibility of null subjects in languages like Chinese and Japanese might follow from the absence of agreement in these languages, in a way parallel to the possibility of null subjects ("PRO") in infinitivals, rather than from a co-indexation relation such as that invoked in languages with overt agreement.
but it also precludes the appearance of a non-empty Noun Phrase. Similar situations are described (though a variety of formally different accounts are proposed) for Breton in Anderson 1982, for Irish in McCloskey and Hale 1984, and for Hebrew in Doron 1988. Despite the heterogeneity of mechanisms that have been described to deal with this wide range of phenomena, all share the notion that agreement, at least in some cases of predicates and their arguments, enters into a relation of co-reference with the position it agrees with.

Given this apparent fact about predicate–argument agreement, it would appear that the relation between agreement and the structural position of the relevant argument falls under the theory of Binding within the syntactic component of the grammar. In that case, we would hope that the relevant principles within the binding theory are those that apply to some other class of referential expressions. In order to determine which such expressions might provide an appropriate analogy, an important thing to determine is the structural scope of agreement relations: if this is restricted to within a single clause (or within the governing category of the agreeing element, such as the Verb), then we would expect the relation between an agreed with position and the agreement it produces to be parallel to that between anaphors (such as reflexive pronouns) and their antecedents. If the scope of this relation is typically greater than a single clause, on the other hand, we would take the behavior of ordinary pronouns to be a better analogy.

In fact, the scope of predicate–argument agreement is quite generally bounded within a single clause. Apparent examples of agreement over longer distances turn out, on closer examination, to involve ‘chains’ of elements, culminating in some structural position which can serve as a strictly local binder for the agreement relation. To see this, consider an example of a language in which agreement appears to operate over a long distance: Icelandic. Here there are two subcases, corresponding to the constructions usually referred to as ‘NP-movement’ and ‘EQUI-NP deletion.’ The first of these is illustrated by the sentences in (7).

(7) a. Dregrinir eru taldir hafa verið kysstir/*kyssta
the-boys (NOM) were considered (NOM) to-have been
kissed (NOM/*ACC)
“The boys were considered to have been kissed”

b. þeir segja drengina vera talda hafa verið kysstir/*kyssta
they say the-boys (ACC) to-be considered (ACC) to-have
been kissed (ACC/*NOM)
“They describe the boys as being considered to have been kissed”

Ignoring the special case presented by the facts of New Guinea languages like Fore, as illustrated in (6) above.
In these examples, we see that the agreeing form (the participle *kysstir/kyssta* "kissed [nom. pl./acc. pl.]") shows obligatory agreement in case, gender, and number with its antecedent, which is apparently *drengirnir/drengina* "the boys (nom. pl./acc. pl.)." If this is indeed a correct description of the phenomenon, it would appear to present an instance in which the agreeing element and its antecedent are not within the same clause, and thus falsify the claim just made. In such a case, however, it is not necessary to describe agreement as obtaining between the principle and the NP "the boys" directly.

The construction involved in (7) involves 'Raising' or 'NP-movement,' by which the NP "the boys" moves from an underlying position in the most deeply embedded clause to a position in the matrix clause. In cases of this sort involving movement, current syntactic theory generally assumes that a phonologically null NP (a 'trace') remains behind in the structural position from which the movement originates. This trace is co-indexed with an antecedent (the moved NP), and the complete set of structural positions through which a NP moves, including its eventual surface position, forms a 'chain' linked by the relation of co-indexation. We can, then, assume that only in its surface position does the NP actually receive its case, but that this value is then transmitted by convention to other positions within the same chain. On this basis, we can say that the participles in (7) are actually agreeing with the (strictly local) NP position in their clause from which the NP "the boys" originated. The values this NP transmits for the agreement features (in this instance, especially the feature of case) are those it inherits from the full NP which serves as the head of its chain. These examples are therefore not counterexamples to the proposal that agreement is always limited to the governing category of the agreeing item.

A second set of examples, given in (8), illustrates a slightly different situation.

(8)  

a. *Í eg bað hann að vera góðan (ACC)/góður(NOM)*  
"I told him (ACC) to be good (NOM/ACC)"

b. *Hann skipaði honum að vera góður(NOM)/góðum(DAT)/*góðan(ACC)*  
"He ordered him(DAT) to be good(NOM/DAT/*ACC)"

c. *Hana(ACC) langar til að vera vinsæl(NOM)/vinsæla(ACC)  
"She longs to COMP be popular(NOM/ACC)"

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20 For a survey of Icelandic complement types, and arguments internal to Icelandic for the analyses accepted here, see Thráinsson (1979, 1983), as well as a substantial subsequent literature.
5.1 Agreement

These sentences differ from the previous examples in two ways. First, instead of the obligatory agreement seen in (7), we find that in some instances more than one form is possible. Second, these structures do not involve movement of the agreed with NP out of a position in the most deeply embedded clause, but rather the "EQUI-NP deletion" construction. The most usual account of that construction within at least the theory of Government and Binding involves a phonologically null element PRO which occupies the subject position in the lower clause, and which is co-indexed with (or 'controlled' by) another NP in the containing clause.

These two factors are inter-related, in the following way. By and large, the generalization about agreement in sentences like (8) is that the agreeing participle may appear either in the same case as the controlling NP, or in the case that would be assigned to the Subject position in the embedded clause. This suggests that the agreement is in all cases with the Subject position of the embedded clause, where the case associated with that position can arise in either of two ways. First, of course, case may be assigned to that position by the normal rules of the language. This results, in sentences like those considered here, in the assignment of Nominative Case to the PRO element in that position, and the possibility of Nominative agreement for the participle. In addition to this, however, the element PRO may optionally be attracted into the Case of its controlling antecedent. If this occurs, the agreement that will appear on the participle will be in accord with the Case of the controller; but in order to achieve this it is not necessary to allow the scope of agreement itself to go outside of a single clause (the governing category of the agreeing item). In all cases, the agreement is strictly local, relating the participle to the Subject NP position in its clause. The rule of Case attraction posited here is not unprecedented: it is similar to the phenomenon in Classical Greek (for which see Andrews 1971), by which a relative pronoun may take either the Case motivated in its (lower) clause, or that of its antecedent in the matrix clause.

21 The presentation and analysis here draws on a substantial literature. For recent discussion, see Anderson (1990a), Andrews (1990) and other work cited or presented in the same volume as those papers.

22 This is usually nominative, of course, but not always: some Icelandic Verbs require their Subject to be in some case other than the nominative. See the references of note 21 of this chapter for discussion.
We conclude, therefore, that the kind of relation obtaining between an agreeing element and the position it agrees with can probably be treated as an instance of the relation between anaphors (in the technical sense of the binding theory) and their antecedents. Not all instances of agreement seem to involve such binding (above and beyond the more limited kind of agreement formalized by simple transmission of features). Insofar as they do, however, the properties of this kind of agreement (i.e. predicate-argument) turn out to be sufficiently parallel to other instances of the binding of anaphors for it to be plausible that the relevant principles form part of the Binding theory. As a whole, then, the theory of agreement forms a part of comparatively well-understood portions of syntactic theory: the theory of categorial (or “X”) structure on the one hand, and the Binding theory on the other.

5.2 The assignment of configurational properties

We now move on to the next aspect of inflectional theory: the assignment of configurational properties. In developing a theory of such rules, an important first step would be to survey the substantive range of phenomena that fall into the category of “configurational properties.” We will largely ignore this here, however (although, as in the case of agreement features, a partial descriptive survey will be found in Anderson 1985a: sec. 2). It seems reasonable to distinguish between two types of assignment: on the one hand, situations in which a property (such as NP case) is assigned purely on the basis of the structural configuration in which an element appears; and on the other, situations in which the property assigned appears to be governed by the requirements of some governing lexical item within the structure (for example, the statement in a descriptive grammar that German helfen takes [+ Dative] objects). We address these two cases in turn.

5.2.1 Structural assignment rules

An example of a purely structural rule assigning configurational properties would be the description of the introduction of ‘genitive case’ in English NPs. In essence, this rule assigns a feature such as [+Genitive] to exactly those NPs that are found in the Determiner position within a larger NP, as formulated in (9).

\[(9) \quad \text{NP} \rightarrow \{+ \text{Genitive} \} / [\text{NP} \leftarrow \text{Det} ] \bar{N} \]

A formal theory of such rules must address a number of issues. Among these are the questions in (10).
5.2 Configurational properties

a. What elements can be assigned features?

b. What aspects of a configuration can be relevant to the assignment of features?

Without attempting to defend this position in any detail, some plausible hypotheses suggest themselves immediately as to the answers grammatical theory might provide for these questions.

With respect to the 'targets' of the assignment of configurational features, it seems reasonable to restrict these by saying that only maximal projections (X\text{max} for some lexical category X) can be assigned features. This class includes S (construed as a projection of COMP), NP, VP, AP, and PP, but not those categories that represent intermediate-level projections of lexical categories (such as N, V, etc.), or indeed the lexical categories themselves (N, A, V, P). Lexical categories can, of course, be assigned features such as case, but we assume that such assignment is never direct: it is not Nouns, that is, but Noun Phrases that are assigned case configurationally. Once a NP has received a given value for case, that value may be transmitted to its head Noun by the mechanisms described in section 5.1.

With respect to the Structural Descriptions of rules like (9), another plausible restriction suggests itself: only other material within the minimal Y\text{max} dominating X\text{max} can be relevant to the assignment of features to X\text{max}. In other words, the internal structure of an NP can be relevant to the assignment of features to a contained phrase (such as another NP, as in (9)), but no material outside of the first maximal projection 'up' from the target phrase can play a role in defining a configuration for the assignment of features. This seems to be the most restrictive view of such rules that one could maintain in the face of the rules which actually seem to be attested in natural languages.

If true, this would seem to entail the claim that (at least in some languages) S, and not VP, is the maximal projection of V (V\text{max}), since the properties of Subjects may be relevant to structural case marking of Objects in, for example, Icelandic. We will see later in this work that this conclusion about the nature of the category S is not an isolated one.

This summary discussion does not claim to constitute a fully developed theory of the assignment of configurational properties on the basis of the structural context in which a phrasal constituent appears. We intend only to have suggested some plausible principles, while pointing out that the assumption that such rules exist (which is made by virtually all theories of

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23 This assumes a fairly traditional notion of what category types X-theory ought to provide. A somewhat different view has arisen out of the syntactic work represented by Chomsky 1986a. The differences are irrelevant to our present concerns.
syntax) carries with it a certain number of issues which must be resolved in a formally explicit way. A productive line to explore might be to relate constraints on the class of structural assignments to the syntactic theory of **Bounding**, together with the principle of monotonicity (formulated as (10) in chapter 4), by which the only operation a rule can perform on a Morphosyntactic Representation is to add features to it.

### 5.2.2 Lexically governed configurational properties

With respect to the lexically governed assignment of configurational properties, the primary question to be answered is whether such a possibility (taken literally) ought to be allowed by grammatical theory. Note that on the view outlined in chapter 4, such a process ought to be impossible, since lexical items are not available to the syntax (and thus cannot serve directly to condition the operation of syntactic rules).

There is, however, an alternative. This is to invoke a notion of **free assignment** of such properties, according to which the rules of the base are allowed to introduce values for features such as case quite freely. Where such features are introduced, however, they affect the structures in which they appear; and they may therefore determine the range of lexical items that may be inserted in (i.e. used to interpret) various positions in these syntactic structures. On this basis, we can then allow the **subcategorization** requirements of individual lexical items to play the role of expressing dependencies between 'case assigners' and the specific cases they require on some of their arguments. In this picture, German *helfen* will subcategorize for a dative Object rather than assigning dative case itself.

The notion of free assignment of properties such as case is needed in any event, because (together with appropriate principles of interpretation), this is what seems to be indicated as the appropriate analysis of 'adverbial' uses of cases (such as the 'accusative of extent' in Old English *Hē seglode fif dagas* "He sailed for five days"). In these instances, the NPs which receive case in such a way are not directly complements of a governing Verb, and the effect of the case marking is to trigger a particular semantic interpretation. When a case-marked NP appears in complement position, however, we must assume that only a Verb which explicitly subcategorizes for that case in that position can govern such a complement.

A potential problem here remains: Verbs are usually assumed not to subcategorize their subjects, but it must be possible in some instances for them to impose idiosyncratic case requirements on this position. This is the phenomenon often referred to in the literature as the assignment of 'Quirky Case' (in e.g. Icelandic). This fact is at least as much of a problem for views that take lexically stipulated case to be assigned directly by the Verb, however.
Verbs do not (on conventional assumptions) govern their Subjects either, and such lexical case assignment is usually taken to require a relation of government between assigner and assignee. In fact, subcategorization and case assignment are completely parallel in this respect. On the other hand, if we say, as suggested above, that the V is head of S (at least in Icelandic), then Verbs might in fact govern their subject, so a subcategorization requirement could characterize this relation.

If it were to be objected that the distinction made here between 'structural' and 'lexical' case requirements is an artificial one, it can be observed in its favor that the two sorts of case may behave differently under syntactic operations. In Icelandic, for example, 'lexical' case is preserved under movement (such as Passive), while 'structural' case is not. This point is illustrated in (11).

(11)  a. Dyrnar eru lokaðar
      door (NOM.PL) are (3PL) closed (ADJ; NOM.PL)
      “The door is closed”

b. Höskuldur lokaði dyrunum
   Höskuldur closed door (DAT.PL)
   “Höskuldur closed the door”

c. Dyrnum er lokað
   door (DAT.PL) is (3SG) closed (PARTICIPLE; N. NOM.SG)
   “The door was closed (passive)”

d. Vegirnir voru gerðir fyrir hestvagna
   roads (NOM.PL) were (3PL) made (M.NOM.PL) for horse carts
   “The roads were made for horse carts”

The Noun dyrnar “door” in Icelandic is a pluralia tantum word, which is grammatically plural even when only a single door is referred to. The Verb loka requires dative case on its Object, a case which remains unchanged under passivization. The result, in a sentence like (11c), is a Subject NP whose dative plural form is preserved. Predicates with non-nominative subjects do not show agreement, and so the form here is the (non-agreeing) neuter nominative singular. In contrast, a Verb like gera “make” does not subcategorize the case of its Object, and so the active form of (11d) would have its Object in the accusative, assigned by a structurally based rule. This accusative is replaced by nominative under passive, as in (11d). Nominative is, of course, the structurally assigned case of Icelandic subjects.

It appears that what is going on here is the following. The Object of a Verb such as loka “close,” which requires a dative, must be assigned that case in the base in order that the subcategorization requirements of the Verb can be met at all levels of structure (as required by the Projection Principle). Ceteris paribus, we expect this case to be preserved under movement, as indeed it is.
A Verb such as *gera* "make," in contrast, does not subcategorize the case of its Object, and so this NP does not bear any case in the structure generated by the rules of the base. If it remains an Object, a structural rule will eventually assign accusative to it, and this is the case which appears on the S-structure Object of the active. When moved into Subject position in a passive, however, it comes under the structural rule that assigns nominative to Subject NPs, rather than the Object accusative rule, and so the passive in (11d) marks this (underlying Object) NP nominative. From these facts we see that there are two quite distinct ways in which Icelandic NPs can receive case, and thus that the notion "V assigns case to its Object" is not a unitary one.

5.3 Deriving the phonological form of inflected words

Most of the theory of inflection as discussed thus far has dealt with the syntactic underpinnings of inflectional properties. The next topic to be addressed is somewhat different: the source of the phonological form of inflected words. Chapter 4 presented a view of the interaction between the lexicon of a language and its syntax on which the lexicon provides stems which can interpret specific structural positions within Phrase Markers. A lexical stem in this sense can be regarded as an idiosyncratic association of phonological, syntactic, and semantic properties. Often, in fact, the same semantic and syntactic properties are associated with more than one lexicalized set of phonological properties: this is the case where we want to speak of a single 'lexical item' with more than one (at least partially) suppletive variant. We will return to this situation below in section 5.3.2. At this point, however, we must address a somewhat different question. Insofar as the inflected forms of a given stem are governed by the regularities of a language, its lexicon provides a single stem form underlying all of them. But in that case, how do the individual phonological forms of inflected words arise?

The answer proposed here is that a set of inflectional Word Formation Rules form part of the grammar, and operate to map lexical words (actually, lexical stems) onto fully inflected surface words. Such an inflectional Word Formation Rule takes as its input a pair \{\mathcal{S}, \mathcal{M}\}; this consists of a phonologically specified stem \mathcal{S} from the lexicon, together with the remainder of that stem's lexical specifications, and the morphosyntactic representation \mathcal{M} of some position in a Phrase Marker which is to be interpreted by (an inflected form of) that stem. Each individual Word Formation Rule operates on the stem \mathcal{S} so as to form a new stem \mathcal{S}' that reflects the phonological effect (such as the addition of affixal material) associated with a part of the word's productive inflection.
5.3 Deriving the phonological form

The Structural Description of such a rule thus includes two sorts of specification: conditions on \( S \) (e.g. the rule might only apply to stems of more than two syllables\(^{24}\)) and conditions on \( M \) (e.g., the rule might apply to Nouns interpreting positions where a [+Ergative] form is required). The Structural Change of a rule may involve, as we argued in chapter 3, not only affixation but also other phonological changes such as metathesis, substitution, deletion, etc. We return to this issue in chapter 8 below. Each rule may be regarded as a sort of generalization of the notion of a ‘morpheme,’ whose form (or significant) corresponds to the rule’s Structural Change, and whose content (or signifié) corresponds to its Structural Description.

We discuss here two of the problems that must be resolved with respect to this notion. First, we must ensure that the surface form contains all of the appropriate material, and that this material appears in the correct position relative to the rest of the form. This is comparable to the general problem of morphotactic organization on structuralist theories of the ‘Item and Arrangement’ sort. Secondly, we must provide an account of the complementarity of regular and irregular modes of inflectional marking. For instance, we must avoid applying a rule for a regular formation such as the English plural in /-z/ to an item which is already lexically specified for the same properties. Thus, since the (irregular) plural of \( ox \) is \( oxen \), we must not produce \( *oxes \) or \( *oxens \). The resolution of this issue is also related to other sorts of complementarity within the system of inflectional rules, and will be the subject of subsection 5.3.2 below. The first subsection below deals with the morphotactic issue.

### 5.3.1 The ordering of Word Formation Rules

To address the question of placing the inflectional formatives of a word in their correct relation to one another, we propose that the set of rules is subject to a language-particular ordering. On that view, the linear descriptive sequence of affixes is reflected in the rule system as the relative ordering of the corresponding rules. That is, the fact that a word has the form \( stem + affix_1 + affix_2 \) reflects the fact that the rule attaching \( affix_1 \) applied ‘before’ the rule that attaches \( affix_2 \). As in any system employing ordering of rules, of course, there is no implication that this order reflects some sort of temporal sequence on the part of speakers. The essential notion is rather a logical one: where rule \( R_i \) precedes \( R_j \) in descriptive order this means that

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\(^{24}\) Note that many of the cases of “phonologically conditioned suppletion” described by Carstairs (1988) can be treated as Word Formation Rules with significant phonological conditions of this sort.
the change(s) performed by \( R_j \) presuppose any changes performed by \( R_i \) to the form.

It is often argued that the imposition of an ordering relation on rule systems such as those of inflectional morphology constitutes an undesirable enrichment of the descriptive power of the theory, and ought to be avoided. This argument does not seem particularly persuasive here, however. The descriptive role of ordering in the current context is the same as that of devices invoked by other theories, such as allowing 'morphemes' to subcategorize for the particular affix (or class of affixes) which they can follow within a word. Given the descriptive fact that rules affixing material to the left or right edge of a base are by far the commonest, most highly valued type (though by no means the only type), the notions of 'order of application of rules' and 'linear order of affixes' are obviously nearly equivalent. The choice between these descriptive modes can hardly be made a priori, but must be based on a consideration of the relatively fine distinctions that can in fact be found.

Further, from the fact that the rules are ordered it does not follow that massive ambiguity of grammatical organization is introduced, corresponding to the different possible orderings that might be invoked among rules where no specific determination is possible (or necessary). We adopt here the theory of ordering introduced for phonological rule systems in Anderson 1974b. On this view, ordering relations can generally be left unspecified, with actual interactions derived from general principles. The grammar of a language must contain an explicit ordering restriction exactly where (a) different relative orderings of a pair of rules lead to distinct results; and (b) the observed descriptive order which must be enforced is one which is not predictable from more general principles. That is, only those orderings which have descriptive consequences and which are idiosyncratic to the language in question need to be specified in particular grammars. This irreducible minimum of descriptive apparatus, in the context of an articulated theory of ordered rule interaction, surely does not constitute an unwarranted augmentation of the theory's descriptive capacity, and does not lead to spurious indeterminacies of grammatical form.

The question of whether rules of the sort envisioned here should apply in sequence is logically separate from that of whether this sequence is (at least in part) a matter of language-particular stipulation, or can instead be predicted from some system of general principles. Naturally, we would be happiest if the necessary ordering relations could be predicted in all instances from a knowledge of the categories that those rules express. This does not appear to be the case, however, since we can find systems in which essentially the same categories are reflected in one order in one language, but in another order in a different language. In support of this claim, compare the marking for case...
Table 5.1  *Two Uralic systems of Noun inflection*

<table>
<thead>
<tr>
<th>Finnish: stem (pl.) (case) (poss.)</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>kirja “book” kirja-ni “my book”</td>
<td></td>
<td></td>
</tr>
<tr>
<td>kirja-t “books” kirja(-t)-ni “my books”</td>
<td></td>
<td></td>
</tr>
<tr>
<td>kirja-ssa “in the book” kirja-ssa-ni “in my book”</td>
<td></td>
<td></td>
</tr>
<tr>
<td>kirjo-i-ssa “in the books” kirjo-i-ssa-ni “in my books”</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vogul: stem (pl.) (poss.) (case)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>haap “boat” haapum “my boats”</td>
<td></td>
<td></td>
</tr>
<tr>
<td>haapan “boats” haapanum “in my boat”</td>
<td></td>
<td></td>
</tr>
<tr>
<td>haapumt “in my boats”</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

and possessor in Finnish and in Vogul (two related languages of the Uralic family) as illustrated in table 5.1. This difference argues that descriptive order is (at least in part) a matter which forms part of the grammatical system of a given language, and is not entirely predictable from general rules.

Of course, the Word Formation Rules under consideration here are highly similar to the class of Word Formation Rules that have been assumed in other work (in the tradition that begins with Aronoff 1976) to deal with derivational morphology. On the present view, derivational rules are Word Formation Rules that operate on stems to create other stems; we will discuss the properties of derivational rules further in chapter 7. We can note here, however, that the class of Structural Changes found in derivation is not distinct from those of inflectional Word Formation Rules.

This fact has sometimes been invoked (in e.g. Lieber 1980) as an argument that inflection and derivation are not distinct, but rather form part of a single system of rules in the lexicon. From the fact that inflectional and derivational morphology share some theoretical apparatus such as a theory of the Structural Changes performed by Word Formation Rules, however, it does not at all follow that there is no reason to keep them distinct. We argued in chapter 4 that there are indeed reasons to separate inflection and derivation, a separation which is reflected on the view being developed here by differences

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25 In fact, we will argue in chapter 8 that this apparatus is also shared by the theory of clitics, which cannot in principle be a part of the theory of the lexicon in the sense intended by Lieber and others. The conclusion we will draw from this is that there is in fact a unified theory governing the Structural Changes of a large and unitary class of rules, but that the rules belonging to this class are found in more than one component of grammar (where the notion of a grammatical component is based on orthogonal aspects of the architecture of grammatical theory).
in the Structural Descriptions characteristic of rules in the two domains, and by the different relations of inflectional and derivational morphology to syntactic structure. The status of the theory of morphological Structural Changes is thus not dissimilar from that often claimed for a single rule, "Move-α," which is said to apply in mapping D-structures onto S-structures, in mapping S-structures onto Logical Form, and even in mapping S-structures onto Phonological Form. That is, the fact that two distinct parts of grammatical theory share some basic notions does not compromise the proposal that there are other notions that differentiate them.

We assume that only lexically complete stems can interpret the Morphosyntactic Representations that appear in Phrase Markers. Since the function of derivation is to construct new stems of this sort, it follows that all derivation must take place prior to lexical interpretation. On the other hand, inflectional operations refer to a Morphosyntactic Representation $\mathcal{M}$ as well as to a stem $\mathcal{S}$, so all genuinely inflectional operations must take place after lexical interpretation. Actually, we regard the operation of inflectional Word Formation Rules as forming a part of the process of lexical interpretation, though this would appear to be largely a matter of terminology rather than of substance.

From these considerations, the descriptive observation that inflectional material occurs "outside of" derivational material follows directly, as stated in (12).

(12) Inflection is outside of derivation. Material introduced into a form $\mathcal{F}$ as a consequence of the morphosyntactic properties $\mathcal{M}$ of the position that $\mathcal{F}$ interprets presupposes the prior application of all morphological processes involved in the derivation of the stem $\mathcal{S}$ on which $\mathcal{F}$ is based, and not vice versa.

This is, of course, a very traditional observation. Indeed, the relative ordering in (12) has sometimes been suggested as (part of) the definition of what it means for some bit of morphology to be 'inflectional' as opposed to 'derivational.' A corollary of this, however, is that what is 'inflectional' or 'derivational' is not a particular formative (much less a morpheme!), but rather a particular instance of a rule application. If this introduces material into a form in response to morphosyntactic properties present at a given position in a Phrase Marker, it is (ipso facto) inflectional. Otherwise it is not.

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26 That is, inflectional prefixes precede derivational ones, and inflectional suffixes follow derivational ones. The situation with respect to other types of morphology is more complex, but analogous.

27 Note that if the principle in (12) is in fact true, it has consequences for the process of acquisition of grammars. If the learner has already established that some part of a morphologically complex form is 'inflectional' in the precise sense being developed here,
This means that the same formative, even in association with the same ‘meaning’ (for instance, the ‘past-ness’ of a past-tense marker) may be inflectional in some cases (where it is syntactically relevant – in the example of ‘PAST,’ for example, where it characterizes a tensed clause) and derivational in others (where no such syntactic basis exists). For example, Khalkha Mongolian $\text{gar-ta-xi}$ “house-LOC-ADJ; domestic” contains a (nominal) locative case marker ‘inside’ the derivational formative $\text{-xi}$. Although $\text{gar-ta}$ “in the house” by itself is an inflected form of the stem /$\text{gar}$/ “house,” with syntactically determined possibilities of occurrence, the marker /$\text{-ta-}/$ “LOCATIVE” is not inflectional in $\text{gar-ta-xi}$ “domestic.” In this form, its properties are not visible to or manipulated by the syntax in constructing phrases involving this word. For the purposes of the syntax, $\text{gartaxi}$ is simply an adjective, and its internal derived status (involving the appearance of /$\text{-ta-}/$) is syntactically irrelevant.

A number of other apparent counterexamples to the claim in (12) turn out, on closer investigation, to be compatible with it. One of these cases is to be found in Baker 1985b, in the course of a discussion of a set of interacting morphosyntactic operations in Chamorro. One of these operations is apparently an agreement rule, which would have unfortunate consequences for the principle in (12). This is because the Chamorro agreement material in question is clearly ‘inside of’ some processes whose character is equally clearly derivational. If the occurrence of the plural agreement material in question is indeed determined within the syntax, its inflectional character would be inconsistent with its place in the grammar.

The intransitive plural agreement facts cited by Baker for Chamorro, however, are shown by Durie (1986) not to be inflectional at all. He argues that what is involved here is a derivational process that alters the semantics of the verbal base so as to specify that its THEME argument (or “most affected” argument, or whatever one wants to call the bearer of this $\theta$-role) must be semantically plural. Durie shows first that this is the right analysis for a number of languages in which verb stems display suppletion for number. Many things make it clear in such languages that this is not usually agreement with the grammatical properties of a corresponding argument, but rather semantic specification comparable to that of verbs like those of Navajo whose Direct Object argument expressions must refer to a long object, a rounded one, etc. In Chamorro, there are at least four reasons to think the plural process Baker notes is not inflectional:

then it should follow that other aspects of the form which are formally ‘outside of’ that material should also be inflectional. This might lead the learner to posit a syntactic instantiation (in the MSRs of relevant words) for some categories whose syntactic status was otherwise difficult to determine. I owe this observation to Norbert Hornstein.
Real inflectional agreement with the Subject (which also occurs in the language) conditions pro-drop, but the plural marker in question does not.

Number in Nouns, Pronouns, and inflectional agreement distinguishes singular from non-singular. The problematic plural-marking process, on the other hand, distinguishes plural (more than two) from non-plural (one or two).

Inflectional agreement is lost (as expected) in infinitives, imperatives, and in attributive position. The problematic plural marker, in contrast, is retained in all of these cases.

The problematic plural morphology is also preserved in lexical derivations, as opposed to real inflection which is not.

We conclude that the facts of Chamorro plural agreement are consistent with its place as a derivational (rather than inflectional) process in the grammar of the language.

On the other hand, insofar as the markers of inflectionally relevant properties in a given form are non-productive or lexically idiosyncratic, they must be present in the lexicon. In that case, their appearance obviously precedes lexical insertion. The fact that such lexically specified inflectional marking precludes the further operation of productive inflectional rules is the subject of the next subsection. We note here, however, that on standard models of Lexical Phonology (see Kiparsky 1982a; Kisse and Shaw 1985), this non-productive inflectional material is generally introduced on an early level of the Phonology, while productive inflection always turns out to constitute the 'last' level. In the present system, this fact follows from the organization of the grammar. Unproductive inflection is a matter of the idiosyncratic composition of stems, and thus logically precedes the invocation of such stems in interpreting syntactic positions. Productive inflection, in contrast, logically presupposes the construction of pairs \( \{S, M\} \) representing positions in Phrase Markers. Its introduction must thus occur at a later point than the introduction of unproductive or lexically idiosyncratic marking for inflectional categories (as well as following the introduction of derivational material, as observed above).

5.3.2 Disjunctive Ordering in inflectional morphology

In order to address the problems of complementarity referred to at the beginning of this section, we need a theory of Disjunctive Ordering in inflectional morphology (see Anderson 1986a). We can begin to construct such a theory by asking about the extent to which the morphological rules of a language are 'compatible' with each other. Consider the set of Georgian verbal prefixes in (13), which we will discuss in more detail in chapter 6.
5.3 Deriving the phonological form

(13) a. g- “second-person Object”
    b. v- “first-person Subject”
    c. m- “first-person singular Object”
    d. gv- “first-person plural Object”

These prefixes all appear immediately before the root of a Verb, in agreement with its arguments. Since the Georgian Verb is marked for agreement both with Objects and with its Subject, the possibility arises that more than one of these prefixes might be motivated by the arguments present in a given sentence. Of the various logical possibilities, some are not possible for other reasons, but the combination of first-person Subject and second-person Object is not excluded by the syntax (or semantics). Despite this, the relevant forms (e.g. mo=g-klav “I will kill you”), only show the overt marker for second-person Object, and not that for first-person Subject. We must therefore provide some account of the failure of this (motivated) first-person Subject marker to appear in the presence of the second-person Object marker. As pointed out above in section 4.2.1, however, there is no plausible basis for the absence of this marker in either the syntactic or the phonological structure of the form. In other words, it seems to be an irreducibly morphological fact. The application of the Word Formation Rule corresponding to the presence of second-person Object features simply blocks the application of the rule corresponding to first-person Subject features. Notice that this does not imply that any syntactically motivated features are removed (or otherwise absent) from the Morphosyntactic Representation of the Verb: only that their presence, under these circumstances, does not result in the application of the rule introducing the prefix v- “first-person Subject”.

To accommodate such examples, it was proposed in Anderson 1986a to allow the morphological rules of inflection to be organized into blocks, where the relation among rules within the same block is a disjunctive one. Rules within such a block are mutually exclusive, in that the first one applicable is the only one that applies. Subsequent rules within the same block, regardless of whether their Structural Description is met or not, are precluded from applying. The blocks themselves (which consist, in the limiting case, of individual rules) are related by (conjunctive) sequence.

We raised the issue above of whether the ordering imposed on morphological rules within the grammar of a language is a language-particular one, as opposed to one which can be predicted uniformly from general principles. The same issue arises, of course, with respect to the relative order of rules within a disjunctive schema: and as in the previous case, we suggest that descriptive order here too is (at least in part) a language-particular matter. To see this, let us consider two closely related linguistic systems which appear to differ in the relative order of a pair of morphological rules.
In the dialect of Cree (an Algonquian language) described in sources such as Wolfart (1973) and Goddard (1967), the inflections of the “you and me” forms (i.e. those involving two non-third-person participants) of the transitive animate Verb are inflected as in (14), where “X” represents the position of the Verb stem.

(14) Object | Subject 1sg. 1pl. 2sg. 2pl.
---|---|---|---|---
 1sg. | — | — | k-X-itin ki-X-itina:wa:w
 1pl. | — | — | ki-X-itina:n ki-X-itina:n
 2sg. | ki-X-in | ki-X-inan | — | —
 2pl. | ki-X-inawa:w | ki-X-inan | — | —

Without developing all of the rules necessary to describe this subpart of the Cree verbal paradigm, we can observe that two of the necessary rules are as formulated in (15).

(15) a. + me + pl
/X/ \rightarrow /Xa:n/

b. + you + pl
/X/ \rightarrow /Xa:wa:w/

The first of these rules adds the suffix /a:n/ to forms involving a first-person plural participant; the second adds /-a:wa:w/ to mark the involvement of a second-person plural participant. Now what is interesting is the case in which we have both first plural and second plural participants; in that event, we see, the first-person plural is marked to the exclusion of the second-person plural. This descriptive fact is formalized by applying the rules in (15) disjunctively in the order given there.

This is not the only system found in Cree, however. In another dialect, referred to by Hockett (1966) and described in Howse 1865, the forms for “we see you (pl.)” and “you (pl.) see us” have the inflection ki-X-itina:wa:w and ki-X-inawa:w, respectively, rather than ki-X-itina:n and ki-X-inan. Otherwise, the “you and me” paradigms in these two forms of Cree are the same. Clearly, the difference between them lies in the descriptive order of the rules in (15): in the first dialect, these apply as given, with marking of first-person plural taking precedence; but in the second, they apply in the opposite order so as to give precedence to the marking of a second-person plural participant. Such an example establishes the point that the relative order of rules within a schema is at least in part a matter of language-particular description rather than general principles.
The disjunctive blocks of this theory are (in part) a reconstruction of the traditional notion of position classes in morphological structure. The fact that only a single rule from each block can apply corresponds to the fact that only a single element can occupy a given position class on that notion of word structure. This interpretation leaves some unresolved questions, however, for future research. For example, on this view a rule of prefixation and a rule of suffixation could potentially belong to the same disjunctive block, although prefixes and suffixes obviously could not be members of the same traditional position class. Does this formal possibility correspond to anything in the grammar of any natural language? On the other hand, it needs to be established that all such stipulated relations of mutual exclusiveness can be described by this mechanism. Suppose that a situation exists which in traditional terms involves the stipulation that prefix $P_i$ of prefix class $m$ is mutually exclusive with prefix $P_j$ of, say, prefix class $m + 3$. This could not be expressed by grouping $P_i$ and $P_j$ into the same disjunctive block (assuming $m$ and $m + 3$ really are distinct classes), since the rules corresponding to classes $m + 1$ and $m + 2$ which must intervene prevent such an organization. Candidate examples of either sort are sufficiently hard to find that we leave these questions open here. They are mentioned only to point out some of the empirical consequences of the particular way in which relations of complementarity are handled here.

Apart from the kind of complementarity of markers represented traditionally by positing position classes and here by disjunction within a block of rules, though, there are other cases in which rules are mutually exclusive. For instance, the Georgian suffix {-t} is used to mark plurality of a number of different argument types, as listed in (16).

(16)  a. first- or second-person plural non-inverted Subjects;
     b. second-person plural non-inverted Objects (Direct or Indirect);
     c. second- or third-person plural inverted Subjects; and
     d. first- or second-person plural inverted (Direct) Objects.

It is natural to ask what this somewhat heterogeneous set of cases have in common. The answer is that (16) enumerates exactly those circumstances in which (a) the number of a Noun Phrase can be registered on the Verb, and (b) there is no more specific marker for that particular circumstance. Thus, third-person plural Subjects require the presence of one of a set of distinct markers, as do first-person plural Objects, and these specific cases take precedence over the 'general' plural marker /-t/.

In Anderson 1986a, it was proposed that the correct analysis of these facts involves the rather simple rule in (17).

28 Third-person plural Noun Phrases in Georgian never show number agreement if they are syntactic Objects.
The theory of inflection

(17) \(/X/ \rightarrow /X + t/\) in the context of [+Plural] (i.e. whenever the feature [+Plural] appears anywhere in \(\#\)).

The apparent complexity of the set of environments in (16) results from the fact that application of this rule is blocked by other more specific rules of Georgian inflection: to wit, those that would mark the number of that argument in a more particularized way. The principle involved here is the one widely known in the phonological and morphological literature as the 'Elsewhere' Principle,29 already mentioned in chapter 2 and formulated here as (18).

(18) "Elsewhere" Principle: Application of a more specific rule blocks that of a later more general one.30

Disjunctive relations among rules as specified by (a) organization of Word Formation Rules into blocks and (b) the operation of (18) accommodate a number of sorts of complementarity among inflectional markers. We are still left with a problem, however: what is responsible for the complementarity of regular and irregular inflection? In general, when a form has an idiosyncratic, lexicalized way of marking some inflectional property, this takes precedence over whatever regular mechanism may exist in the language to mark the same property. There are two aspects to this: given an irregular form such as the English plural feet from foot, we need to explain the absence both of *foots (the predicted regular form) and of *feets (the result of adding regular morphology to the irregular stem).

To resolve these problems, we must examine the notion of a 'lexical item.' In the present framework, a lexical item is a contextually restricted principle for interpreting terminal nodes in a syntactic structure. "Lexical insertion" involves finding a lexical item consistent with the position to be interpreted – that is, one whose lexical characteristics are not distinct from those of the position in question, and whose subcategorization requirements are met by the containing Phrase Marker. The corresponding phonological form is then "inflected," through the operation of inflectional Word Formation Rules, to reflect the morphosyntactic properties of the position. Lexical items thus

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29 This principle is invoked by Anderson (1969), Kiparsky (1973a), Aronoff (1976), Anderson (1986a), Zwicky (1986b), etc., with antecedents going back to Panini, Hermann Paul, and probably others.

30 Note that, at least in this formulation, application of a more specific rules does not block the application of an earlier more general one, nor does it make a uniform prediction about the relative ordering of the general and the specific rules. Stronger principles along such lines may (or may not) be warranted in other areas of grammar, but in the domain of word formation we will see various examples below in which (18) makes the correct predictions as formulated.
provide associations between stems and their syntactic and semantic properties.

Often, however, more than one phonological stem will share the same syntax and semantics. For that case, we need to generalize the phonological component of a lexical entry by defining a notion of **lexical stem set**. A lexical stem set \( \mathcal{S} \) is a group of phonologically distinct stems \( \{ \mathcal{S}_1, \mathcal{S}_2, \ldots \} \) with the same syntactic requirements and semantic interpretation, each associated with its own (partial) set of morphosyntactic properties. Individual stems can in this way be associated with morphosyntactic features (minimally, perhaps, indications of word class) that restrict the range of Morphosyntactic Representations in syntactic structure that they can interpret. Where more than one stem makes up the lexical stem set of a given lexical item, the principle in (19) governs the choice among them.

(19) In interpreting a given Morphosyntactic Representation \( \mathcal{M} \), from among the stems in the lexical set \( \mathcal{S} \) of a given lexical item, only that stem \( \mathcal{S}_i \) which is characterized for the maximal subset of the features compatible with \( \mathcal{M} \) may serve as the basis of an inflected form \( \{ \mathcal{S}_i, \mathcal{M}\} \).

In other words, a lexical stem set may contain several stems with various associated features, as well (perhaps) as a stem with no features beyond its lexical category. In interpreting a position whose Morphosyntactic Representation contains some collection of features, it is necessary to choose the most specifically characterized stem possible, consistent with the features of the position given. Only if no more specific stem is available is the uncharacterized (or default) stem available - though of course, the case of a 'regular' inflected word is precisely that in which this uncharacterized stem is the only stem in the item's stem set.

On the other hand, the only stem in a given set may still bear some features, in which case that lexical item simply cannot be used to interpret positions incompatible with those features. This is the case for certain sorts of **defective paradigms**, such as English *pluralia tantum* Nouns (e.g. *trousers*) which are not usable in the singular.

We are now in a position to account for the absence of forms like *oxes* in English. Such a form, if it existed, would be the result of applying the regular plural rule so as to add /-z/ to the stem /aks/. But in fact the stem /aks/ is not available to interpret a position whose Morphosyntactic Representation contains the features \(+\text{Noun}, +\text{Plural}\) because the only stem set containing /aks/ also contains /aks\text{\text-}\text{an}/. Since this latter stem is characterized for a larger subset of the features \(+\text{Noun}, +\text{Plural}\) than is /aks/, the principle in (19) requires us to use only /aks\text{\text-}\text{an}/ and not /aks/ to interpret such a position.
What about the absence of forms like *oxens, in which regular morphology is simply added to the irregular stem? We might expect such forms to arise automatically, but in general they do not. This suggests that another principle of disjunction (or 'blocking') is at work here. This principle (formulated as (20)) shares an obvious family resemblance with the principles in (18) and (19), since all of these conditions enforce the precedence of specific cases over general ones.

(20) When a rule R of the grammar would apply to a stem \( \mathcal{S} \) on the basis of the features \( \mathcal{F} \) of a given position to be interpreted, application of R is blocked if \( \mathcal{F} \) constitutes a subset of the lexical specifications of \( \mathcal{S} \).

The absence of *oxens and forms like it then follows directly. In interpreting a position with morphosyntactic features [+ Noun, + Plural], we have already seen that only the stem /aksan/ (and not /aks/) is available. In order to derive /aksanz/ it would be necessary to apply the regular plural rule to append /-z/ to /aksan/. This is prevented by (20), however, since the features that this rule refers to are precisely [+ Noun, + Plural], a subset of the lexical features of /aksan/.

We can now define the **paradigm** of a lexical item in terms of its lexical stem set: an item's paradigm is the complete set of surface word forms that can be projected from the members of its stem set by means of the inflectional Word Formation Rules of the language. The paradigm of any particular lexical item will then result from the interaction of the members of its stem set with the inflectional rules of the language: only those derivations consistent with the principles discussed above belong to an item's paradigm.

To summarize the discussion above, we have seen a number of subcases of the relation of complementarity among inflectional principles. These can be described as cases of disjunctive ordering of the following types:

- Between rules, by stipulation (reflecting the organization of rules into blocks);
- Between a specific rule and a later more general rule (per (18));
- Between stems within a lexical stem set, where one stem is more specific than another consistent with the requirements of the position under interpretation (per (19)); and
- Between a specifically characterized lexical stem and a general rule (per (20)).

Numerous cases of such 'double marking' have been suggested in the literature, but in at least a great many instances, they turn out to involve some additional semantic or syntactic distinctions that suggest another analysis. For an account of some such examples, see Anderson (1986a). If genuine cases of such 'double marking' do indeed exist, this would imply that the scope of the principle proposed here as (20) must be limited in some way that is not yet understood.
5.4 Conclusion

It is quite possible that a more general formulation could be found which encompassed all of the cases of (18)–(20). This might, in turn, be identifiable with the principle(s) of disjunctive rule application relevant to the organization in other areas of grammar, such as phonology and the relation between lexical and periphrastic expressions of particular semantic content. On the other hand, there is no reason to believe that other domains of grammar present a direct analog of the language-particular disjunctive relations represented by the organization of rules into blocks. Disjunctive application appears to be a principle of grammar whose exact conditions may vary somewhat from one type of rule to another, while still presenting substantial similarities such as a relation to the notion of the ‘specificity’ of a rule.

5.4 Conclusion

In this chapter we have surveyed some of the important components of a theory of inflectional morphology. We have seen that the mechanisms involved in agreement and in the assignment of configurational properties are closely integrated with more general principles of syntactic theory: at least the principles of categorial structure (or “X-theory”), of Binding theory, and perhaps also of bounding theory are relevant. In deriving the phonological forms of inflected words, we have seen that the Morphosyntactic Representations that serve as terminal nodes of syntactic structure provide conditions that constrain the choice of potential stems from the lexicon, and govern the operation of Word Formation Rules which create actual surface forms from such stems. Finally, we have surveyed a number of principles governing the internal organization of systems of inflectional Word Formation Rules, including relations both of sequential and of disjunctive ordering. In the next chapter, we will illustrate the working of these mechanisms through surveys of the rather complex inflectional systems of two actual languages.

32 Conceived as Disjunctive Ordering, such ‘blocking’ seems quite regular insofar as two forms are clearly isofunctional but one formation is more specific. Outside of inflection, however, it is often hard to be certain of this isofunctionality. Blocking between words and phrases is probably real for fully compositional cases like the English comparative; thus, the existence of redder really does seem to exclude more red, at least in the core sense of the comparative. Poser (1989) also cites some persuasive examples from Japanese. Other cases, however, such as the avoidance of “the day after today” in favor of “tomorrow,” are less obvious. After all, we can define words by phrases, while we cannot possibly “define” men as *mans. It would seem that mere synonymy does not suffice to induce blocking, but what is actually at stake here remains to be explicated. In any case, disjunctive relations are almost certainly a broader phenomenon than just lexical blocking in derivational morphology.
6 Some complex inflectional systems

The two immediately preceding chapters have described a set of mechanisms that allow us to describe inflectional systems. These include a notion of Morphosyntactic Representation and a class of Word Formation Rules which operate to provide the (inflected) phonological form of a lexical stem as it interprets a particular syntactic position. In the present chapter, we exemplify the use of that apparatus in the description of two fairly complex inflectional systems: Georgian and Potawatomi.

Although obviously very different in their overall structure, these two languages have at least one thing in common. In certain cases, the pattern of formal markers associated with the arguments of a Verb is the reverse of what we might otherwise expect in light of purely syntactic evidence. In each case, the existing literature proposes analyses on which actual syntactic restructuring takes place. Such analyses, however, have been motivated by nothing other than the morphology itself, and are apparently based on the assumption that the correspondence between syntactic structure and morphological categories ought to be completely transparent. Insofar as this is not the case, such a view requires that the syntactic account be extended or deformed to bring sentence structure into accord with the apparent requirements of the morphology. Furthermore, at least for Georgian (see Anderson 1984b) and for Cree (another Algonquian language quite similar in structure to Potawatomi: see Dahlstrom 1986), substantive syntactic evidence exists to show that such restructuring of clauses does not take place in the way suggested by the morphology. Our position here, however, is that morphological structure need not be completely isomorphic to syntactic form: in some instances, intricacies within the morphology itself lead to a fairly complex correspondence between the two sorts of structure. In describing such relations, the recognition of a system of inflectional rules is essential. We show that the proposals of the preceding chapters allow a formulation of these non-trivial inflectional patterns without necessitating any (otherwise unmotivated) reorganization of syntactic form.

There is a general moral to be drawn from these cases. Syntacticians, understandably, are interested in providing a syntactic analysis of a language. A traditional view of morphological form, where the morphology consists
simply of an inventory of morphemes and a set of rules for combining and realizing these units, almost inevitably leads to the assumption that the 'inflectional meaning' of an inflectional marker ought to be constant in all of its occurrences. If inflection is a key into syntactic structure, the result is that where a variety of 'inflectional meanings' seem to be conveyed by the same marker, this state of affairs is easily taken to reflect a mapping of several underlying syntactic structures onto the same (morphologically relevant) syntactic form, rather than a complexity in the relation between syntax and inflection.

Given an elaborated theory of syntax (which countenances movement and other structure-changing operations), and a relatively undeveloped theory of morphological realization (for example, one which treats morphemes simply as listed correspondences between sound and meaning), it is natural to locate the complexity in the syntax rather than in the patterns of inflection themselves. When what you have at hand is a hammer, everything tends to look like a nail. By contrast, if we recognize the possibility that morphology too is represented by a (possibly elaborate) system of rules, the way is open to an alternative account on which syntactic form is only indirectly linked to patterns of distribution of the surface forms of morphologically relevant material. In the two cases of apparent 'inversion' to be discussed here, such an analysis seems to have some benefits and to clarify the actual syntax of the languages concerned.

Nonetheless, the point of this chapter is not at all limited to the analysis of the 'inversion' constructions of these (and other structurally similar) languages. Rather, it intends to give the reader a sense of how analyses in the spirit of the present work operate. Individual isolated rules from particular languages are often perfectly adequate to make specific theoretical points, but a somewhat broader context is necessary to understand the place of any such rule in an entire inflectional system. In each of the sketches to follow, many important inflectional subsystems will be omitted from consideration, but what remains should still provide more extensive exemplification of what we take the grammar of inflection to be like than has been present in the earlier chapters.

6.1 Georgian Verb agreement

In this section, we provide a summary description of the inflectional morphology of Georgian, concentrating on the analysis of verbal agreement. We first note the categories for which nominals are inflected, a matter of

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1 For further details of Georgian morphology, see reference works such as Aronson 1982, Tschenkeli 1958, 1960–1974, Vogt 1971, to cite only a few sources in European languages.
some importance for an understanding of the agreement system. After
surveying the patterns of agreement marking in the Verb, we then discuss the
formulation of the rules which yield this agreement, a matter that requires
us to distinguish among the various lexical classes of Georgian Verbs.
Particularly interesting are those Verbs that display apparent inversion of the
marking of their grammatical arguments. Much of the existing literature
assumes that this inverted marking constitutes a \textit{prima facie} case for a syntactic
rule inverting the positions of the corresponding Noun Phrases, but we will
argue that an alternative analysis on which inversion is treated as a
morphological fact without a concomitant alteration of syntactic structure is
possible. Bearing in mind the syntactic arguments for this approach that have
already been presented in Anderson 1984b, it can be seen to be preferable
on purely syntactic grounds.

6.1.1 Georgian NP inflection

The formal inflection of nominal elements in Georgian is quite straightforward
and easily segmented in the surface forms of words. These markers all have
the form of suffixes, and are realized on the head Noun within the Noun
Phrase unless this position is phonologically null.\footnote{There is one other exception to this generalization, which will be described below: in the
case of apparently postposed modifiers, both the head of the NP and the modifier are
fully marked.} In the latter case, markers appear on the last phonologically realized word of the phrase, typically an
Adjective. These points are illustrated by the examples in (1).

\begin{enumerate}
\item\textbf{a.} es axali teoria \\
this new theory \\
"this new theory (nom. sg.)"
\item\textbf{b.} am axali teoriit \\
this new theory-\textsc{instr} \\
"with this new theory (instr. sg.)"
\item\textbf{c.} es axali teoriebi \\
this new theory-\textsc{pl-nom} \\
"these new theories (nom. pl.)"
\item\textbf{d.} am axali teoriebit \\
this new theory-\textsc{pl-instr} \\
"with these new theories (instr. pl.)"
\item\textbf{e.} es axali \\
this new-\textsc{nom} \\
"this new one (nom. sg.)"
\item\textbf{f.} am axalit \\
this new-\textsc{instr} \\
"with this new one (instr. sg.)"
\end{enumerate}
6.1 Georgian Verb agreement

Since modifiers precede the Noun within the Noun Phrase, the cases of full and phonologically null heads can be unified if we assume that inflectional properties are fundamentally assigned to the Noun Phrase, and realized (in the fashion of special clitics) as markers attached to the right of the last phonological word in the phrase. If this last word is a pronoun, however, special lexically idiosyncratic markers take precedence (by disjunctive ordering, as detailed in previous chapters) over the regular marking. We assume, therefore, that the cliticization rule actually transfers the inflectionally relevant features of the Noun Phrase to its last word, and that these features then trigger the operation of word-level inflectional processes. Non-final words within the Noun Phrase show a greatly reduced system of marking which we will largely ignore here (but which shows that some additional feature-transmission mechanisms operate within the Noun Phrase).

The properties for which Noun Phrases are marked are number and case. Number is regularly marked in the modern language by the suffix -eb (followed by case endings), before which stem-final /a/ truncates. Plural agreement is confined to Noun Phrases that are either (a) Subjects; or (b) non-third person; this fact will become important in the discussion of verbal morphology below. An older system in which case and number marking are combined in a single marker is still used in some circumstances, but this will be ignored here. Assuming that nominal elements (Nouns, Adjectives, Demonstratives, etc.) share a feature \[ +N \], the rule to introduce the plural marker could be formulated as (2).

\[
(2) \quad \begin{bmatrix} +N \\ +Pl \end{bmatrix} \xrightarrow{X(a)/} /Xeb/
\]

For expository convenience, we distinguish seven syntactically relevant cases. Of these, two (the ‘Dative’ and the ‘Accusative’) are always identical in form. The divergence between two roles played by this combined ‘Dative–Accusative’ form is not crucial at any point below, and the analysis to be presented could be reformulated without loss of generality so as to

\[^{3}\text{Non-final demonstratives show a difference between Nominative and non-Nominative; Adjectives have an ending -i in the Nominative, Genitive and Instrumental and no ending otherwise. Plurality is not marked in non-final words within Noun Phrases.}\]
eliminate the distinction posited here. We also ignore the Vocative form of Nouns, whose formation is slightly more complicated than that of the other cases, but which will play no role in subsequent discussion. The markers that appear for the cases of potential interest are given in (3).

(3)  

- **Nominative**: ends in -i if the stem ends in a consonant; otherwise unmarked
- **Ergative**: ends in -m after vowel stems, -ma after consonants
- **Dative**: ends in -s
- **Accusative**: same as Dative
- **Genitive**: ends in -is
- **Instrumental**: ends in -it
- **Adverbial**: ends in -ad

Rules to introduce these markers apply after the plural rule (2), and can be formulated as in (4). We ignore here the rules which truncate certain stem-final vowels before certain endings, as well as a few other variations in the shape of markers which depend on the phonological form of the stem and also the rules which syncopate vowels in consonant-final stems when vocalic endings are added. These can be assumed either to be further complication in the formulation of the inflectional Word Formation Rules, or else to be phonological operations whose lexical type (or 'Level') is the same as that of the rules of nominal inflection. In either case, the precise expression of these additional complexities is not important for our present purposes.

(4)  

a. \[ +N \]
\[ +\text{Nom} \]
\[ /X/ = /Y[-\text{Syllabic}]^6 \rightarrow /Xi/ \]

b. \[ +N \]
\[ +\text{Erg} \]
\[ /X/ = /Y[+\text{Syllabic}] \rightarrow /Xm/ \]
\[ /X/ \rightarrow /Xma/^7 \]

c. \[ +N \]
\[ \{ +\text{Dat}, +\text{Acc} \} \]
\[ /X/ \rightarrow /Xs/ \]

4 Verbs do not agree with Vocative NPs, which are outside the normal system of grammatical relations and verbal argument structure that is otherwise relevant to case marking and agreement.

5 See chapter 9 below for some discussion of the notions involved here, which are taken over largely from the theory of Lexical Phonology.

6 This formulation is intended to express the condition "/X/, where /X/ ends in a [-\text{Syllabic}] segment."

7 Note that this case and the one immediately above are disjunctively related, so this change will only apply to stems that do not end in a [+\text{Syllabic}] segment.
The last point which we will note here concerns a difference in inflection between modifiers that precede the head (the normal position, as described above) and those that follow it. As a stylistic option, Adjectives can appear following the Noun they modify, in which case they (as well as the preceding Noun) are fully inflected. There are at least two distinguishable accounts that could be offered of this situation. One possibility is to treat postposed Adjectives as being in fact extraposed, appositive structures. On this view, the postposed modifiers would constitute distinct phrasal constituents with separate inflection. A second possibility is to suggest that the features of Noun Phrases are transmitted both to the head of the phrase and to its rightmost element. In the usual case these will be the same word, but in phrases with phonologically null heads, only the rightmost element (a non-head) will show inflection, while in the case of postposed modifiers, more than one marker will appear. The choice between these two alternatives is primarily a matter of determining the appropriate constituent structure of Noun Phrases with postposed modifiers, and we have no evidence concerning this matter. Either possibility is surely formulable within the assumptions of this work, and the difference plays no role in the subsequent discussion.

6.1.2 Formal categories of the Georgian Verb
When we turn to the morphology of Verbs, we find that there are two principal inflectional categories to be taken into account. The first of these combines tense and aspectual information in a set of categories called 'screeves' in the grammatical literature on Georgian (from the word m€krivi "row"). Ignoring some points of detail, there are roughly eleven of these (though one, the Conjunctive Perfect, is essentially obsolete in the modern standard language). They can be grouped into three series on the basis of their formation, their etymological association with an original aspectual distinction, and (most importantly) differences in the case-marking patterns of their associated arguments. Of these groupings, series I (the 'Present/Future' series) originally represented a set of imperfective screeves, as opposed to the originally
perfective screeves of series II (the ‘Aorist’ series); series III (the misleadingly named ‘Perfect’ series) consists of screeves with a primarily evidential interpretation. Without attempting to describe the substantive differences among the screeves, we simply enumerate them in (5).

(5)  

a. Series I (‘Present/Future’)  
    Present vs. Future  
    Imperfect vs. Conditional  
    Conjunctive I vs. Conjunctive II  

b. Series II (‘Aorist’)  
    Aorist  
    Optative  

c. Series III (‘Perfect’)  
    Perfect  
    Pluperfect  
    (Conjunctive Perfect)

Screeves are marked by various combinations of (a) a set of suffixes which may follow the Verb stem; (b) the possible presence of a specific preverb in certain screeves, where the preverb is selected from a limited set of about two dozen elements, and the same stem may take one of several preverbs with concomitant changes of meaning; (c) stem morphology, including stem suppletion and ‘Ablaut’ relations between, for example, a Present/Future stem and an Aorist stem in some instances; and (d) choice of one of several different formal sets of agreement markers. It is evident that the features characterizing a specific screeve must be available at a number of points in the system of inflectional rules, including the choice of a lexical stem.

In addition to the morphological markers already mentioned, the verbal stem may be preceded by a “version vowel” selected from the set /i/, /u/, /a/, /e/ (or “0,” i.e. no version vowel at all). The version vowel is used in some cases to distinguish screeves; in other instances, it is a lexical idiosyncrasy of a particular stem. The commonest role for this element, however, is to indicate either the addition of an argument (typically an Indirect Object) to the basic argument frame of a Verb, or the elimination of a formal argument position, in the case of a class of reflexive constructions. While there are thus a number of diverse uses to which the version vowel is put, a given Verb has only a single position for such an element, and so can mark only one possible distinction from this set at a time.

* See Harris 1985 for an account of the history of the Georgian screeve system and the distinctions it originally encoded.

* Each of the items within series I identifies a pair of screeves (e.g. ‘Present’ and ‘Future’) which are formally parallel, usually differing in the absence vs. presence of a lexically selected preverb.

* See Harris 1981 and Anderson 1989a for some discussion of this last phenomenon.
Roughly (and ignoring internal morphological complexity within a stem), a Georgian Verb has the schematic form in (6).

(6) (Preverb) – (Agr. prefix) – (version vowel) – Stem – (Screeve marker) – (Agr. suffix)

As should be evident by this point, the morphology of the Georgian Verb is somewhat complex, and a full set of rules to develop all of the material in (6) would occupy us at some length. Since our focus here is on the patterns of agreement morphology, however, we will pass directly to that.

In formal terms, and ignoring screeve-related variation in the shapes of some third-person singular and plural markers, there are effectively six sets of markers that appear in the agreement prefix and suffix positions in the schema of (6), illustrated in table 6.1. These are identified by characteristic members, as the ‘v-set,’ ‘m-set,’ ‘h-set,’ etc. Of these four (the ‘h-set,’ the ‘u-set,’ the ‘e-set,’ and the ‘a-set’) represent combinations of what is structurally a single set of markers with the various possible version vowels (θ, i, e or a). We will refer to these four sets of markers indifferently as “u-set” markers for convenience. Formally, we treat the version vowels as lexically specified, since the occurrence of a particular element from this set is a lexically idiosyncratic correlate of a specific stem as this is associated with a particular subcategorization frame and assignment of θ-roles.

Confining ourselves to clear cases for the moment, the generalizations concerning the use of these markers are quite clear. Roughly, markers from the ‘v-set’ show agreement with the Subject; those from the ‘m-set’ agree with the Direct Object; and those from one or another of the ‘u-set’ markers agree with Indirect Objects.
Prefixed markers from all of these sets, with a single exception to be noted below, are introduced by rules belonging to a single (internally disjunctive) schema. As we have noted at several points in other chapters, only a single agreement prefix can occur, even when more than one would be motivated. The second-person Object marker $g$-, for example, is introduced by a rule which takes priority over the rule introducing the first-person Subject marker $v$- in forms like $g$-$k'lav$ "I am killing you" both would be motivated, but only $g$- appears.

The only prefix rule which is not disjunctive with other prefixes concerns the specific case of a third-person Indirect Object with a Verb whose (basic) version vowel is $i$-. This is marked by changing the $i$- to $u$-, the characteristic of the 'u-set' of markers: compare, for example, $ga$-$g$-$i$-$gzavni$-$s$ "he will send it to you" with $ga$-$u$-$gzavni$-$s$ "he will send it to him." Explicit marking of a third-person Indirect Object in this case, therefore, can occur in the presence of another prefix (for example, $ga$-$v$-$u$-$gzavni$ "I will send it to him"), though other combinations are blocked (for example, $ga$-$g$-$i$-$gzavni$ "I will send it to you," not $*ga$-$v$-$g$-$i$-$gzavni$).

The correspondence between agreement markers from the various sets in

11 Under the influence of the fact that the $i$-$u$ rule for third-person Indirect Objects with Verbs taking $i$ as their version vowel is not part of the same schema with other prefixes, some speakers evidently separate another prefix specific to Indirect Object marking from this schema. As we will note below in chapter 10, the rule introducing $s$/$h$ for third-person Indirect Objects with $0$-version vowel Verbs co-occurs with other prefixes for these speakers, giving forms like $v$-$s$-$txov$ "I ask him it" in place of standard $v$-$txov$. Our account of this fact is simply that such speakers have reanalyzed the rule inserting $s$/$h$ out of the general prefix schema so as to form part of a separate 'third-person Indirect Object prefix schema' that is ordered conjunctively before other prefixes.
Table 6.2. Patterns of agreement in Georgian

<table>
<thead>
<tr>
<th></th>
<th>Subject</th>
<th>Direct Object</th>
<th>Indirect Object</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Pattern A:</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Case Marking</td>
<td>Nominative</td>
<td>Accusative</td>
<td>Dative</td>
</tr>
<tr>
<td>Agreement</td>
<td>v-set</td>
<td>m-set</td>
<td>h-, u-, e-, a-set</td>
</tr>
<tr>
<td><strong>Pattern B:</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Case Marking</td>
<td>Ergative</td>
<td>Nominative</td>
<td>Dative</td>
</tr>
<tr>
<td>Agreement</td>
<td>v-set</td>
<td>m-set</td>
<td>h-, u-, e-, a-set</td>
</tr>
<tr>
<td><strong>Pattern C:</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Case Marking</td>
<td>Dative</td>
<td>Nominative</td>
<td>(tvis phrase)(^{12})</td>
</tr>
<tr>
<td>Agreement</td>
<td>h-, u-, e-, a-set</td>
<td>v-set</td>
<td>(none)</td>
</tr>
</tbody>
</table>

Table 6.1 and grammatical positions is quite straightforward (with the exception of the inversion constructions to be discussed below). The situation with respect to the case marking of these arguments, however, is less straightforward, and depends not only on the grammatical relation the Noun Phrase bears to the Verb, but also on the screeve of the main Verb of the clause. Three patterns are found, as summarized in Table 6.2. One of these, 'pattern A,' corresponds straightforwardly to the case marking of Subjects and Objects in familiar languages of the Nominative/Accusative type. Another, 'pattern B,' which is found for some Verbs in some screeves, corresponds to what is generally described as Ergative/Absolutive marking, while the third possibility ('pattern C') appears to represent a variant Ergative/Absolutive pattern. The circumstances determining which pattern will occur in a given sentence will be discussed in the following section.

With this summary of the morphological apparatus available for the marking of case and agreement in Georgian in mind, we will now consider the ways in which it is deployed as a function of the type of Verb that heads a clause.

6.1.3 Lexical Verb classes

Georgian Verbs fall into several distinct classes with respect to the pattern of agreement and case marking which they determine. The differences among classes also are relevant to other aspects of verbal morphology, such as the formal marking of screeve and the precise shape of third-person Subject markers, but we will only discuss overall patterns in the marking of agreement.

\(^{12}\) In this pattern, Indirect Objects are not treated as arguments of the Verb that take agreement, but rather as external adjuncts expressed by a phrase with the Postposition \textit{tvis}. \(n\text{his}\) sign is another morphological device in the verb to express subject-verb agreement.
Some complex inflectional systems

here. We propose to differentiate these classes in terms of the Morphosyntactic Representations of agreement material with which they are associated, and the ways in which these different structures operate within the full system of inflection in Georgian. We begin with the case of ordinary transitive Verbs such as mo-k’lav-s “(he) will kill (him).” Let us assume that these Verbs, which we will call (with the current literature, such as Harris 1981) class I, have agreement with their Direct Objects recorded in an inner(most) layer of Morphosyntactic Representation, while Subject agreement is recorded in an outer(most) layer. When such Verbs takes an Indirect Object, we can represent that by a third, intermediate layer in the Morphosyntactic Representations. Symbolizing the features distinguishing screeves as ‘T/A’ and the features deriving from an argument in grammatical position ‘GR’ by $F_{GR}$, we thus obtain the schematic forms in (7).

\[
(7) \quad \text{Class I: (ordinary transitive Verbs)} \quad [T/A, F_{Sbj} [F_{Obj}]]
\]
\[
\quad \text{ (same with Indirect Object) } [T/A, F_{Sbj} [F_{IO} [F_{DO}]]]
\]

Since these Verbs show Subject agreement by means of the $v$-series markers, we will take as our starting point the assumption that the rules introducing those markers are conditioned by features present in the outermost layer of the Morphosyntactic Representation. Similarly, rules introducing the $m$-series markers are conditioned by features in the innermost layer of a two- or three-layered structure; and markers of the $h$, $u$, $e$- and $a$- sets are triggered by the middle layer of three.\(^{13}\)

Even simpler than the case of class I Verbs is the description of a large class of intransitive Verbs which we will refer to as class II. Ignoring for the moment the occurrence of these Verbs with Indirect Objects, they have only a single argument and so the most natural characterization would be to assign only a single layer of structure to their Morphosyntactic Representations, as in (8).

\[
(8) \quad \text{Class II: (ordinary intransitives)} \quad [T/A, F_{Sbj}]
\]

The Verbs of class II are predominantly of the type that have been called ‘unaccusative’ in the literature, including the passives of ordinary transitives. There are at least some class II Verbs whose Subjects are agentive, however,

\(^{13}\) Notice that it is only in the third person that the $m$-series differs from the $h$, $u$, $e$, and $a$- sets, assuming that the differences among these latter actually represent differences in the lexically determined version vowel. This means that what we want is a set of first- and second-person Object markers which are simply triggered by features present on a non-outermost layer of structure, and third-person Indirect Object markers triggered by features on the middle layer of three. Since third-person Direct Objects are not overtly marked, no rule is necessary to cover this situation. We ignore this refinement of the actual rules here so as to keep the exposition as simple as possible.
such as imaleba "he is hiding," ikbineba "he bites," ilandzyeba "he abuses, curses" etc. From a synchronic point of view, therefore, the membership of a Verb in a particular class is a lexical fact that is not completely predictable from its semantics or subcategorization.

In series I screeves, Verbs of classes I and II all show pattern A (in figure 6.2 above), or accusative marking. When occurring in screeves of series II, however, the class I verbs show pattern B, or 'ergative' marking. Class II verbs show pattern A in all screeves, which would conform to the descriptive claim often encountered in the secondary literature that Georgian shows an accusative system in some 'tenses' (the screeves of series I), and an ergative system in others (the screeves of series II).

In addition to the intransitives of class II, however, there are other syntactically intransitive verbs that conform to pattern A in series I screeves, but to pattern B in series II screeves. These Verbs, the so-called 'medial' verbs, constitute class III. The syntactic, semantic, and morphological properties of this large and semiproductive class are presented in considerable detail by Holisky 1981. These Verbs are syntactically intransitive, but they are inflected 'as if' they were transitive with a third-person singular Object.

We propose to represent this by assigning class III Verbs a Morphosyntactic Representation that contains a 'dummy' inflectional element in the position occupied by Direct Object agreement marking for class I Verbs. This purely formal element (notationally represented as '0') corresponds to no syntactic argument, and serves purely as a placeholder. In terms of its featural content, it has the values \([-me\ -you]\); unlike agreement corresponding to a syntactic argument, which bears a marker of referential co-indexation (as discussed in section 5.1 of chapter 5), no such referential index is associated with \(0\). Class III Verbs can also be associated with an Indirect Object (e.g. uqeps "(he) barks (at him)" vs. qeps "(he) barks"), marked in the same way as the Indirect Objects of class I Verbs. As a natural extension of our proposals thus far, we arrive at the Morphosyntactic Representations in (9) for class III Verbs.

\[
\text{(9) Class III: ('medial' intransitives) } \{T/A, F_{sbj} [0]\} \\
\quad \text{(same with Indirect Object) } \{T/A, F_{sbj} [F_{io} [0]]\}
\]

While the use of dummy \('0'\) elements in Morphosyntactic Representations provides a formally satisfactory solution to the problem of differentiating class II intransitives from those of class III (and of expressing the similarities between the latter and transitive Verbs of class I), the question remains of how such null elements could arise. We propose that this is a possible result of the operation of agreement. In particular, consider the rule that assigns agreement with a Direct Object argument. Suppose that instead of simply
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saying "Copy the features and referential index from a Direct Object NP to the Verb" this were formulated with the effect in (10a).

(10) **Agreement:**
    a. (Direct Object Agreement:) Copy the features and referential index from a Direct Object NP to the Verb if present; if there is no Direct Object, add θ.
    b. (Indirect Object Agreement:) Copy the features and referential index from an Indirect Object NP to the Verb if one is present.
    c. (Subject Agreement:) Copy the features and referential index from a Subject NP to the Verb if one is present.

In conjunction with the (subsequent) rule of Subject agreement in (10c), this will have the correct result of creating Morphosyntactic Representations like those in (9) for the intransitive Verbs of class III. While solving the problem of how to describe that class, however, we appear to have created a new problem for the description of class II intransitives: why do these not receive the same Morphosyntactic Representations as the Verbs of class III?

A possible resolution of this would be to treat class II Verbs as syntactically unaccusative, along lines that are very familiar from the syntactic literature. On that analysis, we say that class II Verbs are subcategorized to take a Direct Object in D-structure, and that they assign their only θ-role to that argument rather than to the Subject (as class III Verbs do). It will therefore be the case that the Direct Object position will be filled with such Verbs, but the Subject position will not; so the result of agreement will be that the rule in (10a) will operate to produce a representation with only a single layer, as desired. Since the Subject agreement rule (as opposed to Direct Object agreement) does not introduce a θ in the event of an unfilled position, the two Verb classes are differentiated as desired.

Since the single Noun Phrase associated with a Verb of class II has the syntactic properties of a Subject rather than a Direct Object, we need to assume syntactic movement from the Direct Object position to replace an unfilled Subject position, as is standard in 'unaccusative' analyses. The obligatory character of such movement could perhaps be attributed to the fact that an ungoverned empty category in subject position would be ill-formed; movement of the Direct Object to Subject removes this violation while leaving a (properly governed) trace behind.

In the course of this discussion, we have attributed two sorts of properties to Verbs. On the one hand, we assume that Verbs are subcategorized for the syntactic arguments that they take: class I Verbs take a Subject, a Direct Object and (optionally) an Indirect Object; class II Verbs take only a Direct Object; and class III Verbs take a Subject and an optional Indirect Object,
but no Direct Object. On the other hand, Verbs also have an inflectional class, corresponding to the Morphosyntactic Representation with which they are associated. We propose that these are schematic in nature, indicating the number of layers of structure which will occur in the corresponding agreement representation, but not the featural content of that representation. The exception of that is for class III Verbs: these require that the innermost layer of structure in their associated Morphosyntactic Representation be a null element. We can thus represent the Verb class discussed thus far as in (11).

![Image](image-url)

This discussion has assumed that the kind of schematic Morphosyntactic Representations that appear in (11) can be attributed to individual Verbs as a lexical property, but in chapter 5 we described Morphosyntactic Representations as being constructed by operations over syntactic structure. Both are surely necessary, however. At a minimum, lexical items must bear an indication of their category, such as [− Noun, + Verb] (for a Verb). This can be regarded as a minimal, schematic Morphosyntactic Representation, to which the attribution of further structure as in (11) is a direct extension. The use of such schematic forms as part of the lexical characterization of stems is not limited to Georgian, or even to the description of Verbs. Consider the rather common case of languages in which some Noun stems (typically body parts or the like) are obligatorily possessed. If we regard possessor marking in such a language as a kind of NP-internal agreement, obligatorily possessed Noun stems are naturally represented as having a schematic lexical Morphosyntactic Representation similar to that of transitive Verbs in Georgian.

The role of obligatorily null positions in a Morphosyntactic Representation,

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14 The abbreviations "S", "DO," and "IO" in the subcategorization statements in this table should be interpreted as referring to Subject, Indirect Object and Direct Object Positions, however these are to be differentiated structurally. The appearance of "e" in the Subject position of class II Verbs is intended to express the fact that while the phrase-structure rules of the language may always create such a position, these Verbs do not assign it any 6-role, and thus it must remain empty. Note also that Georgian is probably best analyzed as underlying Verb-final.

15 See the discussion of Potawatomi in the second section of this chapter for a concrete example.
too, is not limited to the single purpose for which it was introduced, the
description of the 'Direct Object' position with class III Verb stems. In fact,
there are a number of Georgian Verbs that are inflected as if they contained
an Indirect Object, but where no such argument is (or can be) present.
Examples are given in (12).

(12) a. kari ubevals “the wind blows” (class III)
     b. sonata daukari čemtvis “you played (class I) a sonata for me”
     c. (s)cdada “he tried (class I) it”

In each case, the marker in bold face represents purely formal agreement as
if with a (non-existent) Indirect Object. These Verbs should thus be assigned
lexical Morphosyntactic Representations comparable to those of class I or
III Verbs with Indirect Objects, with the additional property that the
intermediate layer of representation within which Indirect Object agreement
would normally be registered is obligatorily null.

We assume, then, that the actual Morphosyntactic Representations of verbal
agreement in Georgian is constructed in the syntax. Consistent with the general
notion of lexical insertion as lexical interpretation, developed in earlier
chapters, we can say that lexical items also have a schematic Morphosyntactic
Representation as one of their properties; and that only those stems whose
lexical properties are consistent with a given position are eligible to interpret
that position. As a result, the lexical Morphosyntactic Representations serve
to constrain the use of individual Verb stems to those structures that contain
an appropriate array of argument expressions.

We turn next to the mechanism by which morphological case is assigned
to Noun Phrases that are the arguments of Verbs in Georgian. Note that, on
any theory, both the screeve and the inflectional class of the Verb of the
clause must be taken into account in assigning case, since the case-assignment
patterns of table 6.2 above vary as a function of these factors.

We propose that all of the apparatus necessary to assign case has already
been developed above. In particular, the construction of a Verb's
Morphosyntactic Representation (including agreement material) results in the
co-indexation of each argument Noun Phrase with some specific material in
that representation. Let us define a relation “indexed by” which holds between
a Noun Phrase and the agreement material it contributes to the
Morphosyntactic Representation of the Verb; in terms of that relation, we
can formulate the rules of case marking in (13).

(13) a. NP_i is marked [+ Ergative] if it is indexed by [+ Series II, i [X]]
     b. NP_j is marked [+ Dative] if it is indexed by [X][Y]]
     c. NP_j is marked [+ Accusative] if it is indexed by [− Series II, j [(X) [j]]]
     d. NP_j is marked [+ Nominative] otherwise, if it is indexed by i ∈ [+ V]
We have thus far said nothing about how to describe intransitive Verbs of class II if these take an Indirect Object. Verbs of this sort do indeed exist (e.g. elodeba "(he) waits for (him, it)") and we need to ask how they should be represented. Recall that class II Verbs without Indirect Objects are analyzed here as unaccusatives, taking a Direct Object and an empty Subject position (into which the Direct Object eventually moves); and with a single layer to their Morphosyntactic Representation. If we simply added an Indirect Object to this structure, we might expect to derive a two-layered Morphosyntactic Representation, as in (14).

\[(T/A, F_{IO} [F_{sbj}])\]

The problem with this, of course, is that it looks exactly like the representation of an ordinary class I (transitive) Verb with the Indirect Object corresponding to the 'Subject' argument in class I and the Subject to a class I Direct Object, which is not at all what we want. Suppose, however, we represent these Verbs as having a three-layered representation, with the Subject (outermost) layer filled by an obligatory null element as in (15).

\[(T/A, \emptyset [F_{IO} F_{sbj}])\]

To derive this, we would need to allow the 'Subject' agreement rule to introduce such a null optionally when the corresponding position is unfilled, as is the case with unaccusative Verbs. The device of allowing agreement to introduce optional nulls when no corresponding argument is present is independently necessary, however, in order to accommodate the kind of Verb we saw above in (12). We thus propose that a more accurate set of rules for the description of verbal agreement is given in (16).

\[(16)\]

Agreement:

a. (Direct Object Agreement:) Copy the features and referential index from a Direct Object NP to the Verb if present; if there is no Direct Object, add 0.

b. (Indirect Object Agreement:) Copy the features and referential index from an Indirect Object NP to the Verb if one is present; otherwise optionally add 0.

c. (Subject Agreement:) Copy the features and referential index from a Subject NP to the Verb if one is present; otherwise optionally add 0.

There is still one problem to be resolved, however, which concerns the pattern of agreement in class II Verbs. With the exception of class II verbs with Indirect Objects, we could do agreement simply for all Verb forms considered so far: \(v\)-series markers agree with the features in the outermost layer of structure; \(m\)-series markers with the innermost layer so long as there is more than one; and \(h\)-, \(u\)-, \(e\)- and \(a\)-series markers with the middle layer.
Some complex inflectional systems

of three. The problem is that if we adopt the unaccusative analysis of class II Verbs with Indirect Objects, these have their only argument's features on the innermost layer, where they should call for m-series markers. In fact, however, (like other Subjects) this argument is marked by elements of the v-series instead. We could describe this situation with a morphological "Unaccusative" rule, as in (17).

(17) \[ T/A, \emptyset [ Y [ Z ] ] \]
\[ \Rightarrow [ 1 4 [ 3 [ 0 ] ] ] \]

Note that the rule in (17) is a purely morphological rule, not a syntactic rule. It thus applies in the course of developing the inflected forms of words, but its results are irrelevant (and invisible) to processes in the syntax such as case marking by the rules in (13). The existence of such rules that reorganize the internal structure of a Morphosyntactic Representation is of course something we ought to expect if these representations do indeed have the kind of structure we have attributed to them, and that structure is accessible to the rules of morphology. The potential extent of application of such restructuring, however, remains to be determined.

We can note that the rules of case marking given above as (13) will operate correctly on sentences containing Verbs from class II with Indirect Objects, on the basis of Morphosyntactic Representations like (16). The Indirect Object, being indexed by the middle layer of the representation, will be correctly assigned Dative by rule (13b). The Noun Phrase in D-structure Direct Object position will not meet the structural description of rule (13c), since the outermost layer of the representation is a null and thus not indexed; this Noun Phrase will therefore not be assigned Accusative incorrectly. It will, however, be assigned Nominative (correctly) by rule (13d) since it is indexed by a layer of the Morphosyntactic Representation and fails to meet the Structural Description of any of the other rules in the schema (13).

The apparatus necessary to describe the case-marking and agreement system of Georgian, then (at least for the situations we have covered to this point), consists of the following: (a) lexical characterizations of Verbs, as given in (11); (b) agreement rules as represented by (16), which compute the Morphosyntactic Representation of the main Verb of a clause on the basis of its D-structure; and (c) case-assignment rules as in (13), which assign case

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16 We need to supplement (11) with the corresponding lexical type of class II Verbs taking Indirect Objects. These have the subcategorization [S IO _ ] and the schematic lexical Morphosyntactic Representation \[ \emptyset [ - [ - ] ] \].
features to Noun Phrases on the basis of their relation to the Verb's Morphosyntactic Representation.

6.1.4 The inversion construction
The preceding discussion has dealt with case marking and agreement in clauses whose Verb is from class I, II, or III, and whose screeve is from series I (Present/Future) or II (Aorist). These are the circumstances in which patterns A and B of table 6.2 characterize the structure of the clause. There is an additional pattern described in table 6.2, however: pattern C. This is the much discussed 'inversion' construction, found for Verbs of classes I and III in series III screeves, and for Verbs of the hitherto unmentioned class IV in all screeves.18

The generalization represented by this pattern is that where it occurs, the Noun Phrase we might characterize notionally as the 'Subject' displays case-marking and agreement properties identical with those of Indirect Objects in patterns A and B; while the Noun Phrase we might characterize notionally as the "Direct Object" displays the case-marking and agreement properties of a (pattern A) Subject. The question that arises, naturally, is whether pattern C reflects an actual change in syntactic structure ("Inversion," the conversion of a syntactic Subject into an Indirect Object and concomitant promotion of the Direct Object to Subject), as argued by Harris 1981. Alternatively, if this conclusion is not warranted, it is necessary to develop an account of the morphology of pattern C that does not require such syntactic restructuring.

All authors who have considered the 'inversion' construction are agreed that the underlying Subject and Direct Object positions are occupied by the same nominals in both inverted and non-inverted structures: that is, that the D-structures of clauses with pattern C are the same as those with patterns A and B. The issue is whether this structure is converted into a different derived structure by Inversion. Time and space prevent a detailed examination of the question here, but arguments are presented in Anderson 1984b to the effect that a syntactic inversion process is undesirable for several reasons. Note that this conclusion, while strongly supported, is directly applicable only to Georgian; it would be interesting to see how many other "inversion" constructions could be described in morphological terms, but there is no reason a priori to require all languages to be the same in this respect.

17 These case features are then assigned to particular words, of course, by inheritance mechanisms of the sort described in chapter 5.
18 We do not treat the Verbs of class IV (inverted Verbs such as miqvars "I love her") explicitly here, but their analysis is exactly like that of the series III screeve forms of Verbs of classes I and III. For further discussion of these Verbs, see Anderson 1984b.
How, then, might we develop an account of morphological pattern C without requiring such syntactic restructuring? In fact, the apparatus developed in the preceding subsection already contains most of what is necessary for this. The essence of the morphological alternative is to suggest that 'inverted' verbal forms have a Morphosyntactic Representation exactly like the corresponding two-layer uninverted Verb, but with an extra null outer layer. The \([+\text{Series III}]\) stem of a class I Verb, then, will have a Morphosyntactic Representation that looks like (18).

\[(18)\quad [+\text{Series III}, \theta [F_{sbj} [F_{obj}]]].\]

The series III form of a class III ('medial') Verb will look just the same, except that the innermost layer will contain a null element. In fact, the 'inverted' forms of class III Verbs are inflected as if they had an extra, invariantly third-person singular argument as their 'Direct Object.'

Note that (18) looks just like the representation we found for class II Verbs taking Indirect Objects, except that the middle layer indexes the Subject instead of an Indirect Object and the innermost layer indexes the Direct Object instead of the Subject. Despite this difference, however, these representations are still subject to the morphological 'Unaccusative' rule (17).

How are we to create representations such as (18)? There are two distinct aspects to the answer to this question. First, we need to characterize the perfect (series HI) stems of class I and III Verbs\(^{19}\) as requiring such a Morphosyntactic Representation for the position which they interpret. This can be done by incorporating such a change into the lexical rule that forms these stems. Since the formation of the series HI stem of a Verb is at least partially idiosyncratic, there must be a (system of) rules in the lexicon to describe it. These rules will have a phonological aspect (adding appropriate markers to the stem), and a morphological aspect which includes the change in (19).

\[(19)\quad [X[Y]] \Rightarrow [+\text{Series III}, \theta [X[Y]]].\]

In addition, we need to allow the mechanism of agreement to create Morphosyntactic Representations like (18) in the syntax. These consist of exactly the representation that would otherwise be computed for clauses of the relevant type, with an additional null element in an outermost layer. To this end, we propose a final formulation of the rules of agreement, as in (20). These rules copy person and number\(^{20}\) features as well as an index from NPs onto the MSR. The procedure is as follows: agreement works its way cyclically

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\(^{19}\) Verbs of class II form their series III screeves in a completely different fashion, which does not involve 'inversion' and is thus irrelevant here.

\(^{20}\) Recall that plural number is not copied from third-person non-Subject Noun Phrases; this refinement has not been formally incorporated in (20).
through a list of argument positions. Only the first rule (for the Direct Object position) is obligatory; the others are optional. At each point, a dummy (θ) with the inflectional properties of a third-person singular Noun Phrase but no index may be assigned instead. This corresponds to the fact that, as we have seen above, Georgian Verbs may show dummy agreement of a purely formal sort with any one of their inflectional argument types.

(20) Agreement:
   a. (Direct Object Agreement: Obligatory) Copy the features and referential index from a Direct Object NP to the Verb if present; if there is no Direct Object, add θ.
   b. (Indirect Object Agreement: Optional) Copy the features and referential index from an Indirect Object NP to the Verb if one is present; otherwise add θ.
   c. (Subject Agreement: Optional) Copy the features and referential index from a Subject NP to the Verb if one is present; otherwise add θ.
   d. (Dummy Agreement: Optional) Add θ.

The case-marking pattern associated with the ‘inversion’ construction follows from the rules we have already posited in (13) above, as these would apply in sentences whose Verbs have Morphosyntactic Representations like (18). The Subjects of such clauses are indexed by a middle layer of the Morphosyntactic Representation, and are thus assigned Dative case; the Direct Objects are indexed by the innermost layer of a representation whose outermost layer does not index any Noun Phrase, and thus receive Nominative case in the same way as the Subjects of class II Verbs with Indirect Objects. The agreement pattern results from the operation of the morphological Unaccusative rule (17), together with the same morphological rules of verbal affixation as those that apply elsewhere. Nothing else need be stipulated about the construction, and no syntactic rule of ‘Inversion’ is necessary.

It might appear that the rules we have provided (particularly the agreement rules in (20)) will describe a large number of ill-formed structures, as well as those that are motivated. In fact, however, the apparent overgenerating nature of this apparatus is constrained by (a) the fact that every Noun Phrase must be indexed in order to receive case by the rules in (13); and (b) the fact that the representations constructed must also be interpretable by existing lexical entries. Each of these has as a lexical characteristic (substituting exactly for a traditional ‘conjugation class marker’) a schematic Morphosyntactic Representation. Lexical items also have subcategorization requirements, and the relation between lexical Morphosyntactic Representation and subcategorization is only partially fixed (corresponding to the fact that verbs with the same subcategorized set of arguments may belong to different classes).

There are several notable features of the analysis which we have provided
above, including at least the following: (a) the role of the Morphosyntactic Representations constructed by the agreement process in the assignment of morphological case to Noun Phrases; (b) the functioning of a rule of ‘Morphological Unaccusative’ (17) in relating the syntactically motivated representation of agreement to its morphologically realized form; and (c) the indirectness of the relation between the syntactic position occupied by an argument and its inflectional characteristics. All of these function crucially in providing a coherent account of Georgian inflection, and in enabling us to avoid the (otherwise unjustified) claim that “inversion” constructions in this language involve an actual reorganization of the syntactically motivated structure of clauses. While novel from the perspective of theories that take morphology to be the study of inventories of ‘morphemes,’ these properties follow directly from the conception adopted in the present work.

6.2 Potawatomi inflectional morphology

We now turn to a completely different language, Potawatomi\textsuperscript{21} of the Algonquian family. The discussion here is limited to the forms of Nouns, possessed and unpossessed, and to Verb agreement in the independent indicative order. Other verbal categories exist as well, but the extension of this account to them would serve primarily descriptive ends rather than the present goal of instantiating the theoretical framework. Like Georgian, Potawatomi has a complex inflectional system, but in this language the complexity lies more in the formal expression of inflectional categories within words than in the relation between morphological and syntactic structure. Our discussion below will thus focus more on the rules that construct inflected words than was the case for Georgian, and less on the interaction of morphology with syntax. Some themes common to the two languages will emerge, however.

There are two principal points which will emerge from the system of rules we develop below. First, we will see that a large number of rules generalize across the inflections of Nouns and Verbs. As can be seen in many languages, the inflectional markers of the possessors of Nouns and of the Subjects of transitive Verbs share much (but not all) of their formal expression. Similarly, the markers of the Nouns themselves overlap extensively with the inflection of intransitive Subjects and transitive Objects. Apart from suggesting that

\textsuperscript{21} Information on Potawatomi comes primarily from Hockett 1948, with some details from Goddard 1967. The analysis to be developed below owes much to the insights of Hockett (1966 and elsewhere), though I have no reason to imagine that he would subscribe to what I have to say.
Morphosyntactic Representations and their correlated formal markers within words have a certain degree of abstractness, this overlap between the nominal and verbal systems provides us with useful information about the internal structure of the Morphosyntactic Representations themselves. Secondly, we will see in the relation between the ‘direct’ and the ‘inverse’ forms of Potawatomi transitive Verbs another case in which an articulated theory of morphology obviates a putatively syntactic rule of clause restructuring which has no non-morphological support in the syntax of the language.

Before discussing inflection in Potawatomi, we must first sketch some phonological regularities that underlie the transcriptional system used here, which is generally based on the morphophonemic representations of Hockett 1948. A number of processes depend on the distinction between ‘weak’ vowels (Hockett’s /u/, phonetically [a] unless syncopated as discussed below, and /O/, phonetically [o] unless syncopated) and “strong” vowels. The vowel written /u/ is always ‘weak’; some instances of [o] (representing etymologically short vowels) are ‘weak,’ while other (etymologically long, but synchronically indistinguishable) [o]s are strong. With Hockett, we distinguish the two phonologically as /O/ vs. /o/. The vowels /a, e, i/ are always ‘strong.’

Abstracting away from numerous details discussed in Hockett 1948, the major rules needed to relate phonological representations to phonetic ones are the following. When two consonants come together at morpheme boundary, the resulting cluster is broken up by the insertion of /u/. In vowel clusters, /u/ is lost adjacent to another vowel, while /O/ is lost adjacent to a ‘strong’ vowel. When both vowels in a bisyllabic word are ‘weak’ the first is lost. Final ‘weak’ vowels are lost (unless constituting the only remaining vowel of the word). Thus, /uk:u/ becomes [k:s] “land” but does not lose its final weak vowel. In other cases, within any sequence of consecutive syllables with weak vowels, the odd-numbered weak vowels are lost in non-final syllables.23 The result is a system in which the addition of a prefix can (by altering which vowels in a sequence are in even numbered syllables and which in odd) result in dramatic changes in the surface shape of stems. For instance, /pomOS:e/ yields [pomos:e] “he’s walking,” but /n+pomOS:e/ yields [nompomos:se] “I’m walking” (from /nupomOS:e/ by epenthesis). Additionally, the glides /w/ and

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22 A small number of phonetic [a]s in loan words are invariant. We assume these words are simply lexical exceptions to the rules of syncope.

23 It appears that the vowel-deletion processes could be described on the basis of a simple metrical analysis of Potawatomi words. Assuming that syllables with ‘weak’ vowels are themselves weak, we can formulate this in the terms of, for example, Hayes (1991) as: (a) build iambs (i.e. maximally disyllabic, right-strong feet, where any disyllabic foot has a weak syllable as its left member) from left to right; (b) delete weak vowels in weak position within the foot; (c) delete word-final weak vowels unless they are the only remaining vowel of the word.
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/y/ are replaced by [ʔ] before /w, o/ and /y, i/ respectively. Other phonological processes that are less important for an understanding of the Potawatomi inflectional system will be ignored here.

6.2.1 Potawatomi Noun inflection

The categories for which Nouns are inflected in Potawatomi include gender, obviation, number and possession. As a lexical (inherent) property, each Noun is either animate ([+ Anim]) or inanimate ([— Anim]). This classification is roughly semantic in its origins, but as in other Algonquian languages, there is a certain amount of arbitrariness and idiosyncrasy: thus, while body parts are generally inanimate, /muk:utakon/ “fur” and a dozen or so others are animate; plants and their products are generally inanimate, except for about twenty including /muk:otemon/ “blackberry;” as well as about a hundred or so other exceptionally animate forms such as /ʔemuk:wan/ “big cooking spoon,” /wapokun/ “clay,” etc.

Animate Nouns (actually, Noun Phrases) may further be classified as obviative ([+ Obv]) or proximate ([— Obv]), based primarily on the role of their referent in discourse. There are syntactic constraints on the distribution of obviative and proximate Noun Phrases, however. Within a clause, at most one third-person argument of a given Verb can be proximate; all others are necessarily obviative. Further, when an animate Noun is possessed by a third-person animate, the possessed Noun is necessarily obviative. Beyond these factors, the choice is a matter of narrative structure. Roughly, an obviative Noun Phrase is one referring to a participant who is less central to the situation described by the sentence than is some other third person. Obviative Nouns are not distinguished for number in Potawatomi, while proximate plurals are formally marked. In addition, Nouns may be marked for the person and number of their possessor.

We begin with the inflection of simple, unpossessed Nouns. Since inanimate Nouns are not marked for obviation, they have only two forms:

(21) /ciman/ “canoe”; sg. [ciman]; pl. [ciman]

Animate Nouns, on the other hand, have distinct inflections for number and for obviation:

24 See Goddard 1990 for a recent discussion of the role of obviation in discourse organization in another Algonquian language, Fox. Dahlstrom (1986) also discusses the discourse determinants of obviation in Cree, in much the same spirit. Various authors have suggested that syntactic conditions on obviation go far beyond the factors cited here, but to the best of my knowledge all studies based on a consideration of extended textual material have been quite unambiguous in suggesting that the difference between proximate and obviative is primarily manipulated (or at least manipulable) on the basis of the structure of discourses rather than of sentences, subject to only limited syntactic factors.
To account for these facts, we need two rules of inflection: one to add /k/ to animate plurals, and one to add /n/ to inanimate plurals and to obviatives. Anticipating later results, we observe that the Nouns that are subject to these processes are neither first- nor second-person stems. We can formulate the necessary rules as in (23).

(23) a. 
\[
\begin{array}{c}
-\text{me} \\
-\text{you} \\
+\text{Anim} \\
+\text{Pl}
\end{array}
\]

/X/ → /Xk/

b. 
\[
\begin{array}{c}
-\text{me} \\
-\text{you} \\
\{+\text{Pl}\} \\
\{+\text{Obv}\}
\end{array}
\]

/X/ → /Xn/

By assigning the two rules in (23) to a single disjunctive schema, we obtain the result that animate plurals are not marked for obviation, while only inanimate plurals are marked with /n/. The form [čiman(-an)], of course, results from the insertion of epenthetic /o/ in the result of suffixing /n/ to /čiman/.

Let us now consider the inflection of a possessed Noun. We take first the possessed forms of the inanimate Noun [čiman] "canoe."

(24) Possessed:

<table>
<thead>
<tr>
<th>Possessor:</th>
<th>3sg.</th>
<th>3pl.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1sg.</td>
<td>nčiman(om)</td>
<td>nčiman(m)an</td>
</tr>
<tr>
<td>2sg.</td>
<td>kčiman(om)</td>
<td>kčiman(m)an</td>
</tr>
<tr>
<td>3sg.</td>
<td>wčiman(om)</td>
<td>wčiman(m)an</td>
</tr>
<tr>
<td>1225</td>
<td>kčiman(m)an</td>
<td>kčiman(m)an-anan</td>
</tr>
<tr>
<td>13</td>
<td>nčiman(m)an</td>
<td>nčiman(m)anan-anan</td>
</tr>
<tr>
<td>2pl.</td>
<td>kčiman(m)an(an)</td>
<td>kčiman(m)an-anan</td>
</tr>
<tr>
<td>3pl.</td>
<td>wčiman(m)an(an)</td>
<td>wčiman(m)an-anan</td>
</tr>
</tbody>
</table>

25 We use "12" to indicate the first-person plural inclusive (i.e., a form including the speaker and the addressees), as opposed to "13" for the first-person plural exclusive (including the speaker and others, but not the addressee).
Before we can analyze this paradigm, we must first provide an appropriate Morphosyntactic Representation for possessed Nouns. As we can see from the forms in (24), these are marked separately for the properties of both the possessor and the possessed, and thus the two sets of features must be kept distinct in the Morphosyntactic Representation. We assume, therefore, that possessor marking results from an agreement rule that assigns the features of the possessor to a Morphosyntactic Representation that already contains those of the possessed Noun. By the principle of Layering (see (12) in chapter 4), this results in a two-layered Morphosyntactic Representation with features for the possessed in an inner layer and those of the possessor in the outer layer. When the Noun /čiman/ “canoe” is marked for a second-person plural possessor, for example, the result is to convert the representation in (25a) into that of (25b).

(25) a. 

\[
\begin{array}{c}
+ \text{Noun} \\
- \text{me} \\
- \text{you} \\
- \text{Pl} \\
- \text{Anim}
\end{array}
\]

b. 

\[
\begin{array}{c}
+ \text{Noun} \\
- \text{me} \\
+ \text{you} \\
+ \text{Pl} \\
+ \text{Anim}
\end{array}
\]

On this basis, we can now proceed with the forms in (24). We note first they are based on the lexical stem /čiman/, optionally extended by /-(o)m(u)-/. We assume this to be basically /-m-/; the presence (and absence) of /o/ vowels can be attributed to the independently motivated rules of epenthesis and syncope. This /-m-/ appears in the stems of some possessed Nouns, but not others. A substantial number of Nouns (including most body-part and relationship terms, as well as some others) are “dependent,” in the sense that they can only appear in possessed form; these do not show /-m-/ as a distinct formative, but its appearance with other Nouns is a lexical idiosyncrasy.

The class of dependent Nouns just mentioned can be treated in a way similar to that proposed in the previous section for Georgian Verbs. Just as a Georgian transitive Verb of class I is assigned a lexical Morphosyntactic Representation with two layers of structure, a Potawatomi Noun stem such as /os:/ “father” can be assigned a schematic Morphosyntactic Representation
as part of its lexical entry that specifies the existence of two layers of structure. As a result, such a Noun stem can only interpret a position in syntactic structure where a corresponding two-layered structure exists.

What, then, of the formative /-m-/? We can say that this is introduced by a derivational rule within the Potawatomi lexicon: a rule that relates stems associated with internally unstructured Morphosyntactic Representations to corresponding augmented stems associated with an internally layered representation. This rule affects the phonological and morphological properties of an item, without altering its semantics. It creates, in effect, a dependent stem corresponding to a non-dependent one, and can be tentatively formulated as in (26).^2

\[
(26) \quad \begin{array}{c}
+ \text{Noun} \\
- \text{me} \\
- \text{you} \\
\alpha \text{Anim}
\end{array} \Rightarrow \begin{array}{c}
+ \text{Noun} \\
+ \text{me} \\
- \text{you} \\
\alpha \text{Anim}
\end{array}
\]

/\alpha\text{m}/

As a derivational rule, (26) has the function of creating new lexical stems. Since the Morphosyntactic Representation of the derived dependent stem is more specifically characterized than the underived, unspecified stem, the principles of disjunctive ordering will require its use to interpret any position to which it is applicable (i.e. any possessed Noun position), such that the underived stem will only be able to interpret unpossessed Noun positions. As is true for derivational relations in general, the existence of a stem derived by means of (26) for any particular Noun is a lexical idiosyncrasy. In some cases, such as that of /čiman/ “canoe,” the optionality of the /-m-/ extension in the possessed form can be interpreted as fluctuation between a lexicon with and without such a derived stem for this item.

To the appropriate stem (possibly including the lexical extension /-m-/) are then added inflectional affixes marking the properties of the possessed and of the possessor. We see first of all that the forms in (24) are marked by a set of prefixes indicating the person of the possessor. The prefix /k-/ appears whenever the possessor involves a second person; otherwise, the prefix /n-/ appears where a first person is involved; and when the possessor includes

---

26 While the formation of a possessive stem does not in general alter the semantics of a Noun, there are some cases where some change does occur: thus, [ná:wem] “my sister” is a dependent Noun which is obviously the possessed form of /k:we/ “woman.”

27 We will discuss the nature and content of derivational rules in greater detail in chapter 7 below.
only third-person referents, the prefix /w-/ appears. We can formulate this as the schema of three disjunctively ordered rules in (27).

\[(27) \quad \text{a. } [ + \text{you} \ [ ] ] \\
\quad /X/ \rightarrow /kX/ \]

\[\text{b. } [ + \text{me} \ [ ] ] \\
\quad /X/ \rightarrow /nX/ \]

\[\text{c. } [ [ ] ] \\
\quad /X/ \rightarrow /wX/ \]

The suffixes in the possessed inanimate paradigm (24) can be grouped into two sets. At the right edge of the form, we find a suffixed /-n/ (with epenthetic /u/ when this follows a consonant) in all of the forms in which the possessed Noun itself is plural, but not where the possessed Noun is singular. Clearly this is due to the operation of the same rule as that marking inanimate plurals in general, the second rule of (23). In possessed Nouns, therefore, this rule must attend to the inanimate plural features on the inner layer of structure; in fact, as we have formulated the rules in (23), under conventions suggested in chapter 4 they will analyze precisely the innermost layer of structure of the representation, as required.

In addition, we need two further rules to introduce affixes that are conditioned by plurality of a Noun’s possessor. The markers involved are /-nan/ for first-person plural possessors, and /-wa/ for plural possessors not involving a first person; the rules introducing them form part of a single disjunctive schema.

\[(28) \quad \text{a. } \begin{bmatrix} + \text{N} \\
\quad + \text{me} \ [ ] \\
\quad + \text{Pl} \end{bmatrix} \\
\quad /X/ \rightarrow /Xnan/ \]

\[\text{b. } \begin{bmatrix} + \text{N} \\
\quad [ ] \\
\quad + \text{Pl} \end{bmatrix} \\
\quad /X/ \rightarrow /Xwa/ \]

28 These prefixes appear as /kut-/ /nut-/, and /wut-/, respectively, before stems that begin with a weak vowel. They also have this form optionally before consonant-initial stems. Historically, this represents a case of rule inversion: original Algonquian initial /t-/ was lost, except when protected by the presence of a prefix. The analysis of the intrusive /t/ in possessive forms is ignored here; apparently a rule is required to insert an initial /t/ in all possessed Noun forms, depending on their phonological shape and applying before the prefixation rules of (27).
Possessed animate Nouns have a paradigm entirely parallel to that of inanimates; the only substantive difference is the marking of animate possessed Nouns for obviation. Consider the paradigm of the (dependent) Noun /os:/ “father” in (29).

<table>
<thead>
<tr>
<th>Possessor:</th>
<th>Possessed:</th>
<th>3sg.</th>
<th>3pl.</th>
<th>3obv.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1sg.</td>
<td>nos:</td>
<td>nos:ak</td>
<td>nos:an</td>
<td></td>
</tr>
<tr>
<td>2sg.</td>
<td>kos:</td>
<td>kos:ak</td>
<td>kos:an</td>
<td></td>
</tr>
<tr>
<td>3sg.</td>
<td>—</td>
<td>—</td>
<td>Pos:an</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>kos:nan</td>
<td>kos:nan:ak</td>
<td>kos:nanan</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>nos:nan</td>
<td>nos:nan:ak</td>
<td>nos:nanan</td>
<td></td>
</tr>
<tr>
<td>2pl.</td>
<td>kos:wa</td>
<td>kos:wa</td>
<td>kos:wan</td>
<td></td>
</tr>
<tr>
<td>3pl.</td>
<td>—</td>
<td>—</td>
<td>Pos:wan</td>
<td></td>
</tr>
</tbody>
</table>

The forms with third-person possessors require two remarks. First, the prefix /w-/ becomes [?] before the vowel /o/, as already noted; and secondly, since an animate third person possessed by another third person is necessarily obviative (as already noted), there are no proximate singular or plural forms in this case. Otherwise, the rules already given in (27), (28) and (23) suffice to account for the paradigm in (29).

We conclude the discussion of Noun inflection by considering the independent pronouns in Potawatomi, listed in (30).

<p>| | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1sg.</td>
<td>nin</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2sg.</td>
<td>kin</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3sg.</td>
<td>win</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>kinan</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>ninan</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2pl.</td>
<td>kinwa</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3pl.</td>
<td>winwa</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

These forms are structurally similar to the paradigm of a possessed Noun: we suggest that independent pronouns should be regarded as possessed forms of a stem /in/ (perhaps glossed “self”). The only unusual features they display are (a) degemination of /-in-nan/ to /-inan/; and (b) the absence of obviative marking in the third-person forms (perhaps due to the non-referential nature of the stem /in/“self,” which might therefore not undergo obviation).

6.2.2 Potawatomi Verb inflection

We turn now to the inflection of Verbs. As in other Algonquian languages, Potawatomi Verbs are divided into four distinct conjugations, based on their
transitivity and on the animacy of an associated argument. Verbs not taking a formal Object are intransitive. These are further divided into two subclasses depending on the animacy of their Subjects: Inanimate Intransitive ("II") Verbs and Animate Intransitive ("AI") Verbs. Verbs taking a formal Object, in contrast, are divided into classes not on the basis of properties of their Subjects, but rather on the basis of the animacy of their Objects. We thus have Transitive Inanimate (TI) Verbs and Transitive Animate (TA) Verbs to round out the class system. The four classes are separated quite rigidly on the basis of the morphological gender class of the relevant argument. Relations between Verb stems with similar semantics but belonging to different classes (e.g. /wišukya/ "be hard (II)" vs. /wišukos/ "be strong (AI)"; /wapot/ "see (it; TI)" vs. /wapom/ "see (him/her; TA)"; /wepi?/ "run away from (him/her; TA)" vs. /wepi?uwe/ "run away (AI)," etc.) are matters of lexical derivation rather than of inflection.

**Inanimate Intransitive Verbs**

In terms of their inflection, II Verbs are particularly simple. Since their Subject is necessarily inanimate, it cannot be first or second person; thus, only three forms exist in the paradigm of a Verb like /wawuyeya/ "be round" as in (31).

(31) a. wawyeya "it is round"
   b. wawyeyaton "they are round"
   c. wawyeyanan "it (obv.) is round"

The final [(s)n] of the plural and obviative forms is just what we would expect on the basis of (23). Although those rules were originally formulated for the inflection of Nouns, they need not be restricted to Nouns in their applicability. Leaving them as originally stated will result in the suffixation of /-n/ to any stem with a Morphosyntactic Representation whose innermost layer includes the features either of an inanimate plural or an obviate, including the case of II Verbs.

On the other hand, there do appear to be two affixes whose appearance is peculiar to II Verbs. These are the elements /-to/ of the plural form, and the first /n/ of the obviative. Apparently we must posit two specific processes to introduce these, ordered before the rules of (23).

(32) a. \[
\begin{array}{c}
+V \\
-\text{Anim} \\
+\text{Pl}
\end{array}
\]

\[
/X/ \rightarrow /Xto/
\]

29 See Anderson 1991 for some discussion of the difference between syntactic and purely formal objects in Algonquian and other languages.
b. \[
\begin{array}{c}
+V \\
-\text{Anim} \\
+\text{Obv}
\end{array}
\]

\[
/X/ \rightarrow /Xn/
\]

The form \textit{wawyeyan}:ni "it (obv.) is round" thus undergoes two distinct operations suffixing /-n/: one applying specifically to II Verbs with obviative Subjects, and one applying to any form with the features of a third-person obviative in its innermost layer of Morphosyntactic Representation.

\textbf{Animate Intransitive Verbs}

Let us now consider the paradigm of an AI Verb, as in (33).

\begin{enumerate}
\item [33] /\textit{kasiukumi}/ "start running"
\end{enumerate}

\begin{itemize}
\item [1sg.:] nkask:ami
\item [2sg.:] kkask:ami
\item [3sg.:] kask:ami
\item [3obv.:] kask:amin
\item [12:] kkask:amin:an
\item [13:] nkask:amin:an
\item [2pl.:] kkask:amin
\item [3pl.:] kask:aminik
\end{itemize}

Comparing this paradigm with the others we have already accounted for, we see both similarities and differences. Beginning with the prefixes, we find the same /k-/ and /n-/ elements marking participation of a second- or a first-person referent, respectively, that occurred on possessed Nouns. The rules in (27) were originally formulated to apply precisely to two-layered structures, but the appearance of the same prefixes with AI Verbs (whose Morphosyntactic Representations evidently have only a single layer of structure) suggest that the real generalization is that the /k-/ and /n-/ rules are triggered by the presence of [+ you] and [+ me] (respectively) on any layer of structure. Since unpossessed Nouns are always [−me, −you] (recall that independent pronouns are analyzed here as formally possessed forms of the stem /in/), no other problem arises for the cases already discussed. We will see below that this generalization makes exactly the correct prediction for the case of transitive Verbs, as well. We conclude that, with this modification, the /k-/ and /n-/ rules should be considered to generalize across both Nouns and Verbs. The rule for third-person possessors, however (which introduces a /w-/) does not apply in the AI paradigm, so we conclude that it does not

\(^{30}\) The cluster /sk/ formed by loss of weak \(\ddot{u}\) becomes /sk:/ by a regular phonological rule.
generalize to representations with only a single layer of structure. The prefix rules thus appear to have the form in (34).

(34) a. + you
   /X/ → /kX/

b. + me
   /X/ → /nX/

c. [ ]
   /X/ → /wX/

Moving to the suffixes in the AI paradigm, we find an element /-mon/ which marks first-person plural (inclusive or exclusive) forms, and an element /-m/ for second-person plural. These are analogous to the markers /-nan/ and /-wa/ introduced by the rules in (28) for plural possessors, and suggest that we should expand that schema to include additional cases applicable only to Verbs. The revised schema is given in (35); we anticipate later results by generalizing as many rules as possible to forms other than Nouns. We also provide for the new rules to apply in the transitive paradigms that are yet to be considered by formulating them in terms of features present in the outermost layer of the Morphosyntactic Representation.

(35) a. [+ Noun
    + me (X)
    + Pl]
       /X/ → /Xman/

b. [+ me (X)
    + Pl]
   /X/ → /Xmon/

c. [+ Pl [ ]
   /X/ → /Xwa/

d. [+ you (X)
    + Pl]
   /X/ → /Xm/

The only remaining material to be accounted for in the AI forms is the suffixal /-n/ and /-k/ in the third-person obviative and plural forms,
These are obviously the animate plural and obviative suffixes which we have already seen in several places, and are introduced in these forms (as in the Nouns) by the rules in (23).

**Transitive Inanimate Verbs**

We move on now to transitive Verbs. Along the lines of preceding chapters, we assume these have a Morphosyntactic Representation with two layers of structure, analogous to that of possessed Nouns, with the features of the Direct Object present in the inner layer and those of the Subject on the outer layer. Consider first the paradigm of a TI Verb such as that in (36).

(36) /wapot/ “see (it)”

<table>
<thead>
<tr>
<th>Subject</th>
<th>3sg. Object</th>
<th>3pl. Object</th>
</tr>
</thead>
<tbody>
<tr>
<td>1sg.</td>
<td>nwaptan</td>
<td>nwaptan</td>
</tr>
<tr>
<td>2sg.</td>
<td>kwaptan</td>
<td>kwaptan</td>
</tr>
<tr>
<td>3sg.</td>
<td>ñwaptan</td>
<td>ñwaptan</td>
</tr>
<tr>
<td>12</td>
<td>kwaptaman</td>
<td>kwaptaman</td>
</tr>
<tr>
<td>13</td>
<td>nwaptaman</td>
<td>nwaptaman</td>
</tr>
<tr>
<td>2pl.</td>
<td>kwaptanawa</td>
<td>kwaptanawan</td>
</tr>
<tr>
<td>3pl.</td>
<td>ñwaptanawa</td>
<td>ñwaptanawan</td>
</tr>
</tbody>
</table>

Beginning once again with the prefixes, we see that these correspond to the Subject, and are the same as those that appear on possessed Nouns: /k-/ for a second-person participant, otherwise /n-/ for a first-person participant, otherwise /w-/ (which becomes [ʔ] before the initial /w/ of the stem /wapot/). The rules formulated above as (34) account for this material, again generalizing from the original case of Nouns to that of Verbs.

Turning to the suffixes of TI Verbs, we note first an invariant element /-a/ which immediately follows the stem in all of the forms in (36). This appears to be a characteristic of (the Independent Indicative of) transitive Verbs, as expressed by rule (37).

(37) \([ + \text{Verb } ]]\)

\[
/X/ \rightarrow /Xa/
\]

Consider next the forms with plural Subjects. In the first-person inclusive and exclusive (12 and 13) forms, we find the element /-mun/: in fact, rule (35b) above as already formulated will introduce this element in exactly these forms without modification. In the case of second- and third-person Subjects,

---

31 Though this /-a/ might appear to be part of the TI stem itself, it is not: it does not appear, for example, in conjunct forms. The corresponding element in the conjugation of TA Verbs alternates with other stem formatives in a way that makes its status as a separate affix even clearer.
we find the sequence /-nawa/. Now in fact, rule (35c) as formulated above will introduce the /-wa/ part of this sequence, which appears to be a general marker for non-first-person plural elements in the outer layer of a complex Morphosyntactic Representation. The remaining material /-na/ must be introduced by a rule specific to the TI class of Verbs, applying before the rules in (35).

(38) 
\[
\begin{align*}
\text{+ Verb} \\
\text{-me} & \quad \text{[-Anim]} \\
\text{+ Pl} & \\
\end{align*}
\]

\[/X/ \rightarrow /Xma/\]

The only remaining piece of the paradigm of the TI Verb which varies with the properties of its Subject is the final /-n/ of forms with singular Subject. This cannot be identified with any affix we have seen previously; since it is restricted to the TI paradigm, we formulate (39) below as an additional rule within the schema of (35). All of these rules (as well as the rules in (32), specific to the II Verb paradigm) introduce members of a mutually exclusive class of suffixes which occupy structurally parallel positions in a variety of inflectional formations.

(39) 
\[
\begin{align*}
\text{+ Verb} & \quad \text{[-Anim]} \\
\end{align*}
\]

\[/X/ \rightarrow /Xn/\]

The final feature of (36) is the difference between the forms with singular Object and those with plural Object. Other paradigms show a final /-n/ in plural Object forms. Since the Morphosyntactic Representations of these forms will have the features of a plural third-person element in their innermost layer, we expect rule (23b) to add this /-n/ in the presence of plural Objects. What is not expected is the absence of the inanimate plural /-n/ in the forms with first-person plural Subject, forms which in fact have no overt indication of the number of their Object. It is necessary to find some way to prevent the otherwise motivated appearance of an additional /-n/ here.

One possible device would be a rule of deletion, which would eliminate a final plural /-n/ in the presence of a preceding affix /-mun/. Apart from the absence of evidence for a derivation in which final /-n/ is inserted (presumably triggering epenthetic /u/ insertion) and then deleted, there is another reason not to believe in this account. Looking ahead to the paradigms of TA Verbs, it appears that the real generalization is that no marker corresponding to the features of an Object appears for Verbs in which first-person plural Subjects are marked by /-mun/. That is, not only the inanimate plural /-n/ but also the animate plural /-k/ and obviative /-n/ are missing under these conditions.
These facts naturally suggest an analysis on which the outer-layer first-person plural marker /-mun/ is introduced by a rule that is disjunctively related to the inner-layer rules of (23), and blocks their application. In the present framework, however, this is impossible: the /-mun/ rule must be part of a disjunctive schema with the other suffixation rules of (35) and (32), but the number and obviation suffixes of (23) generally co-occur freely with suffixes other than the first-person plural verbal suffix /-mun/.

An alternative is to regard the lack of any final (Object-marking) suffix as in fact constituting one of the disjunctive alternatives for this position. On that account, we could propose the rule in (40) as the first member of the schema (23).

\[
(40) \quad \begin{array}{c}
+ \text{Verb} \\
+ \text{me} \\
+ \text{Pl} \\
\end{array}
\]

/\text{Xmun/} \rightarrow /\text{Xmon/}

Such a rule (whose structural change is explicitly vacuous) is the formal equivalent within the present theory of a 'zero morpheme' on morpheme-based accounts. It describes a situation in which the lack of any overt marker is correlated with a specific situation (and in which such a lack of marker is mutually exclusive with certain other specific markers). In this case, by coming first in the block of rules containing (23), rule (40) has the effect of preventing the appearance of a formal marker for number or obviation in the inner layer under the conditions specified in its Structural Description.

It should be evident that the role of rules like (40) is much more circumscribed in the present theory than the role of 'zero morphemes' in morpheme-based theories. In most cases where a property has no overt marker in a form, this is due simply to the absence of any rule that would introduce one, or to the pre-empting (by disjunction) of an available rule by other rules competing for the same position within a single schema. Only under very special circumstances need we posit such a formally empty rule: just in case some set of rules must be precluded from applying in the presence of certain morphosyntactic features.

**Transitive Animate Verbs**

We turn finally to the most complex inflectional paradigm in Potawatomi, that of the TA Verb. Discussion of these forms is conventionally divided into three subparts, and we will follow that expository sequence here as well. We begin with the forms in which the Object is third person (singular, plural or
Some complex inflectional systems

obviative) and the Subject is first person, second person, or third-person proximate. These forms are illustrated for a typical Verb in (41).

(41) /wapum/ “see (him/her/them)” (direct forms)

<table>
<thead>
<tr>
<th>Subject</th>
<th>3sg. Object</th>
<th>3pl. Object</th>
<th>3obv. Object</th>
</tr>
</thead>
<tbody>
<tr>
<td>1sg.</td>
<td>nwapma</td>
<td>nwapmak</td>
<td>nwapman</td>
</tr>
<tr>
<td>2sg.</td>
<td>kwapma</td>
<td>kwapmak</td>
<td>kwapman</td>
</tr>
<tr>
<td>3sg.</td>
<td></td>
<td></td>
<td>ñwapman</td>
</tr>
<tr>
<td>12</td>
<td>kwapmaman</td>
<td>kwapmaman</td>
<td>kwapmaman</td>
</tr>
<tr>
<td>13</td>
<td>nwapmaman</td>
<td>nwapmaman</td>
<td>nwapmaman</td>
</tr>
<tr>
<td>2pl.</td>
<td>kwapmawa</td>
<td>kwapmawak</td>
<td>kwapmawan</td>
</tr>
<tr>
<td>3pl.</td>
<td></td>
<td></td>
<td>ñwapmawan</td>
</tr>
</tbody>
</table>

The forms in (41), referred to in the Algonquianist literature as “direct,” can be entirely accounted for by rules already developed. The prefixes /n-/, /k-/ and /w-/ (which becomes [?] before the initial /w/ of the stem /wapum/) are introduced by the rules in (23). The first post-stem suffix element, /-a/, is introduced by rule (37). The elements /-mon/ and /-wa/, marking first- and non-first plural Subjects respectively, are introduced by the rules of (35). The suffixes /-k/ and /-n/ for plural and obviative Object respectively, are introduced by (23); the absence of these suffixes in forms with first-person plural Subjects is accounted for by the “zero” rule of (40). The entire TA direct paradigm, then, is accounted for with no change to the grammar as developed thus far.

A more problematic part of the TA paradigm is the set of forms called ‘inverse’ in the traditional literature, where either (a) the Subject is third person, and the Object first or second; or (b) the Subject is obviative and the Object proximate. Consider the forms in (42).

(42) /wapum/ “see (him/her/them)” (inverse forms)

<table>
<thead>
<tr>
<th>Object</th>
<th>3sg. Subject</th>
<th>3pl. Subject</th>
<th>3obv. Subject</th>
</tr>
</thead>
<tbody>
<tr>
<td>1sg.</td>
<td>nwapmak</td>
<td>nwapmakok</td>
<td></td>
</tr>
<tr>
<td>2sg.</td>
<td>kwapmak</td>
<td>kwapmakok</td>
<td></td>
</tr>
<tr>
<td>3sg.</td>
<td></td>
<td></td>
<td>ñwapmakon</td>
</tr>
<tr>
<td>12</td>
<td>kwapmaknan</td>
<td>kwapmaknanok</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>nwapmaknan</td>
<td>nwapmaknanok</td>
<td></td>
</tr>
<tr>
<td>2pl.</td>
<td>kwapmakwa</td>
<td>kwapmakwak</td>
<td></td>
</tr>
<tr>
<td>3pl.</td>
<td></td>
<td></td>
<td>ñwapmakwan</td>
</tr>
</tbody>
</table>

The similarity in organization of the subparadigms (41) and (42) is evident. There are two significant differences between them: (a) the inverse forms in (42) have a stem forming element /-ukO/ in place of the /-a/ of the direct
6.2 Potawatomi inflectional morphology

forms in (41); and (b) the morphology that indicates properties of the Subject in the direct forms indicates properties of the Object in the inverse forms, and vice versa.

Eschewing pure brute force, there are a variety of ways in which the similarities and differences between (41) and (42) could be accounted for. Given the system of rules we have developed to this point, and the natural way in which the direct forms of (41) fit within that system, it would appear that what we want is for the Morphosyntactic Representations of TA Verbs calling for inverse forms to differ systematically from those associated with the direct forms. If the Subject features of inverse forms appeared in the inner layer of structure, and the Object features in the outer layer, the rules already introduced (supplemented by one introducing the characteristic inverse formative /-ukO/) would provide the correct inflections. There are, however, several ways in which this difference in structure might be produced.

In some sense the simplest way to achieve the desired result would be to apply the Subject agreement rule before Object agreement in just those cases where inverse forms will be called for. This would have the effect of reversing the layers on which the two sets of features appear; but not without other unfortunate consequences. First, there is no other indication that the sort of factor(s) involved here can result in different relative orders of application of morphological rules. Furthermore, simply reversing the order of the agreement rules would result in complete merger of the two subparadigms; and while they are substantially similar, they are still distinct. In addition to the replacement of /-a/ by /-ukO/, the inverse paradigm uses /-nan/ instead of /-mon/ to mark first-person plural forms. Rule ordering alone, then, even if it were available as a variable to be manipulated in this way, is unlikely to resolve the problems posed by the TA inverse subparadigm.

Alternatively, the relation between (41) and (42) might be attributed to the operation of a syntactic rule. It might be suggested, that is, that a syntactic operation akin to passivization applies to structures of the appropriate sort, interchanging the Subject and Object arguments. If this rule left some mark on the Verb (e.g. the feature '[+ Inverse]') it could keep the two subparadigms distinct while still accounting for the fact that by and large, Subjects of these forms are treated like Objects of direct forms and vice versa. The problem of how to relate the direct and inverse forms is one that arises in all of the Algonquian languages, not just in Potawatomi, and indeed the morphology of Algonquian has led some writers (e.g. Rhodes 1976 for Central Ojibwa,

32 Recall that the forms of TI Verbs also have this element /-a/, though they have no inverse forms which would call for its replacement by /-ukO/.
LeSourd (1976 for Fox) to argue that inverted forms are produced through a syntactic reorganization of clauses akin to passive. The arguments for this position in those works, however, have come exclusively from the morphology. Since what we are looking for is a way to account for the morphological pattern, it would seem necessary to provide arguments from syntactic operations (and not just patterns of morphological marking) for the claim that such clause-internal restructuring takes place in the syntax. In fact, however, when we look for such arguments, they do not appear to exist; and indeed Dahlstrom (1986), discussing Cree, shows on syntactic grounds that no such syntactic inversion should be assumed, at least for that language. Dahlstrom shows that the morphology of the inverted forms in Cree is systematically misleading as an indicator of the associated syntactic structure.

It is of course possible that in some Algonquian languages, genuinely syntactic arguments exist for a (non-morphological) process of inversion. While similar in important ways, the languages of this family are nonetheless distinct, and it is quite possible that a surface pattern which is purely a matter of complex morphology in some languages is treated as syntactically motivated in others. We know of no argument supporting such a syntactic account for Potawatomi, however.

But if there is no motivation for an alteration of the syntactic structure of clauses to produce the ‘inverse’ forms of TA Verbs, we should treat this phenomenon as morphological, which is exactly what would result from an alteration of the morphosyntactic structure. We propose, then, that the correct account of the Potawatomi inverse forms should be based on a rule interchanging the agreement features derived from the Subject Morphosyntactic Representations with those from the Object. Such an interchange is registered formally by the presence of the inverse stem formative /ukO/. The forms involved are those in which either (a) an obviative Noun Phrase acts on a proximate animate participant; or (b) a third person acts on a non-third person.

(43) $\begin{array}{c}
+\text{Verb} \\
\quad \begin{cases}
+\text{Obv} \\
-\text{me} \\
-\text{you}
\end{cases}
\end{array}$

This rule results in an interchange of Subject- and Object-marking properties, but with no concomitant change in syntactic structure. It is thus
a morphological rule, posited to account for what we claim is a morphological (rather than a syntactic) fact. It is, of course, entirely possible that this rule had its origins in a syntactic process of passivization. As we will discuss in chapter 13 below, syntactic processes that become obligatory in alignment with some morphological category may be reanalyzed so that their formal marks are reinterpreted as marks of the category in question, obviating any syntactic reorganization. If, as we hypothesize, an original passive construction became obligatory precisely for certain combinations of Subject and Object person (and inapplicable otherwise), the marker of that construction might be reanalyzed as purely morphological in its synchronic function, with the elimination of the original structural change of passivization. Comparative evidence (see Goddard 1967) makes it likely that the formative /okO/ which characterizes the inverse forms of the TA Verb was originally a passive marker. We suggest that in the historical stage illustrated by Potawatomi as discussed here (and by Cree as discussed in Dahlstrom 1986), it has become simply part of the apparatus of person marking in these (and perhaps other) Algonquian languages.

Rule (43) applies disjunctively with respect to rule (37), the rule which introduces the formative /a/ characteristic of the direct forms of the TA Verb (and of the TI Verb); these rules thus form a single schema.

Most of the remaining material in the forms in (42) follows from rules we have already established. The prefix elements /k-/, /n-/, and /w-/ (which becomes [?] before the initial /w/ of /wapum/) follow from rules (34). The final /-k/ for plural and /-n/ for obviative Subjects follow from rule (23), since the Subject features of the inverse Verbs will now be present in the innermost layer of structure after rule (43) applies. The element /-wa/ for non-first-person plural Objects will follow from rule (35c), since the features of these Objects will now appear on the outer layer of structure as a consequence of (43). The only problematic element of the inverse paradigm is the marker /-nan/ for first-person plural Objects. If the Morphosyntactic Representations of inverse TA Verbs were precisely inverted from those of the direct forms, we would expect first-person plural Objects to trigger the marker (/-mun/) normally associated with first-person plural Subjects (which in turn should preclude the appearance of /-k/ for plural and /-n/ for obviative Subjects, as we have seen).

Of course, we do have a rule that introduces /-nan/ in forms with first-person plural features in the outermost of two layers of structure: rule (35a), which marks first-person plural possessors of Nouns. Unfortunately, we cannot simply extend this rule from Nouns to Verbs, for that would result in /-nan/ incorrectly replacing /-mun/ in first-person plural subject forms of TA direct (and TI) Verbs. In fact, however, when we compare the TA inverse paradigm
of (42) with the paradigm of a possessed animate Noun in (29), we find that they are the same in all relevant respects. We could accommodate that observation by saying that the rule creating inverse forms not only interchanges the features of Subject and Object, but also converts the morphological pattern from that for a transitive Verb into that of a Noun. We thus replace rule (43) with (44).

(44) 
\[
\begin{array}{c}
+ \text{Verb} \\
\{ + \text{Obv} [\{ - \text{Obv} + \text{Anim}] \} \\
\{ - \text{me} [\{ + \text{me}] \} \\
\{ - \text{you} [\{ + \text{you}] \}
\end{array}
\]

[ + Verb 1 [2]] \rightarrow [ + \text{Noun} 2 [1]]

/X/ \rightarrow /\text{Xuko}/

Note that in the theory of the present work, this does not mean that TA inverse Verbs have the syntax of (possessed) Nouns, but only their morphology. This rule, like other morphological rules, forms part of the process of lexical interpretation of syntactic Phrase Markers. Its effects are therefore not visible to rules operating on syntactic structure per se and do not affect their operation.

The final subparadigm of the TA Verb is that of forms involving only first- and second-person participants. In the syntactic structures corresponding to these ("you and me") forms, normal principles of disjoint reference prevent the Subject and Object from overlapping in person. The remaining forms are illustrated in (45).

(45) /wapum/ "see (him/her/them)" ("you and me" forms)

<table>
<thead>
<tr>
<th>Object</th>
<th>Subject</th>
<th>1sg.</th>
<th>1pl.</th>
<th>2sg.</th>
<th>2pl.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>lsg.</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>kwapman</td>
<td>kwapmanam</td>
</tr>
<tr>
<td>1pl.</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>kwapmanman</td>
<td>kwapmanman</td>
</tr>
<tr>
<td>2sg.</td>
<td>kwapam</td>
<td>kwapmanam</td>
<td>—</td>
<td>—</td>
<td></td>
</tr>
<tr>
<td>2pl.</td>
<td>kwapam</td>
<td>kwapmanam</td>
<td>—</td>
<td>—</td>
<td></td>
</tr>
</tbody>
</table>

The first thing we can note about these forms is that they all involve the prefix /k-/ for second person, regardless of whether the second-person participant is Subject or Object. That is, however, exactly the result we would

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33 Where we would expect both Subject and Object to be [+you] or both to be [+me], syntactically intransitive reflexive forms appear instead of TA Verbs. The same is of course true when expected third-person Subject and Object would otherwise be co-referent.
predict from the generalization of the /k-/ prefixation rule to the form in (34a), which applies when the feature [+you] appears anywhere in a Morphosyntactic Representation. Given the other properties of Nouns and Verbs which we have already discussed, and the operation of the inversion rule (44), it is only in the "you and me" forms that the features of a non-third person could appear on a layer other than the outermost, but here they do and the result is as expected.

In the "you and me" forms the stem is followed neither by the /-a/ of the direct nor by the /-ukO/ of the inverse subparadigms. Instead, we find markers that are sensitive to the person and number of the Object: /-n/ where this is second person, /-y/ where it is first-person plural, and nothing where it is first-person singular. The first two cases seem to represent further rules of the same schema that includes (44) and the general transitive /-a/ theme rule.

\[(46)\] a. \[\{[+you]\}\]
\[/X/ \rightarrow /Xn/\]

b. \[
\begin{bmatrix}
[+me] \\
[+Pl]
\end{bmatrix}
\]
\[/X/ \rightarrow /Xy/\]

The absence of any overt theme formative could be attributed to the operation of another 'zero rule' which expresses a specific circumstance in which no suffix from this class appears. Alternatively, and more parsimoniously, we could avoid positing such a rule by restricting the /-a/ theme suffixation rule to cases in which the inner layer of the Morphosyntactic Representation has the feature [−me]. We have no formal basis to choose between these alternatives, but arbitrarily choose the latter possibility in the final summary to be presented in the appendix to this chapter.

Moving on to the post-theme suffixes, we find /-mun/ in forms involving a first-person plural participant; as in the case of the prefix /k-/, this is independent of whether the argument in question is Subject or Object, and suggests that this rule too should be formulated to apply when the relevant features are present anywhere in the representation.

\[(47)\] \[[+me] \\
[+Pl]
\]
\[/X/ \rightarrow /Xmun/\]

Finally, we note that forms involving a second-person plural participant but not a first-person plural bear the suffix /-m/. Now in fact we already have a rule that introduces /-m/ to mark second-person plural participants,
motivated by the AI paradigm. We might propose to generalize this in the same way we generalized the /-mon/ rule to yield (47), resulting in (48).

\[ \begin{align*}
&+\text{you} \\
&+\text{Pl} \\
&/X/ \rightarrow /Xm/
\end{align*} \]

As it stands, however, rule (48) will suffix /-m/ to numerous forms where it should not. In fact, in the TI paradigm as well as both the direct and the inverse subparadigms of TA Verbs, second-person plural participants (like other outer-layer plurals) are marked by /-wa/, not /-m/. This suggests that the generalization of the /-m/ rule should be confined to the “you and me” subparadigm of TA Verbs. We can, in fact, achieve exactly that result in an economical fashion: simply by ordering rule (48) within the same disjunctive schema as the /-wa/ rule (as we have already done), and formulating the latter so as to apply everywhere except in the “you and me” subparadigm of TA Verbs, whenever an outer-layer participant is plural.

\[ \begin{align*}
&[+\text{pl}[-\text{me}]] \\
&/X/ \rightarrow /Xwa/
\end{align*} \]

We have now accounted for all of the inflected forms of Nouns (possessed and unpossessed), and for the Independent Indicative (affirmative) forms of Verbs from all four classes (II, AI, TI and TA). A summary of the final forms or the rules arrived at constitutes the Appendix to this chapter. While this discussion has necessarily been rather detailed (and would become even more so if we were to incorporate additional aspects of Verb inflection), there are two rather general points that we hope to have made. First, the rules involved are all rather straightforward in their formulation, once their interaction with other rules of the system is correctly understood. Furthermore, a number of these rules generalize across the inflection of Nouns and Verbs, on the basis of features which may be present in the Morphosyntactic Representations of inflected words belonging to either class. And secondly, the complexity that does exist in the inflectional system of Potawatomi can be described entirely within the rules of the morphology. It is not necessary, in particular, to adjust syntactic structure in ways that are not strictly motivated by syntactic (as opposed to morphological) phenomena. In this, the description of Potawatomi just given reinforces the same point as it was made in the discussion of Georgian in the previous section.
Appendix: summary of Potawatomi inflectional rules

Rules grouped together under a single arabic numeral constitute a single, disjunctively ordered schema. These schemata are applied in sequence; within each schema, the first applicable rule blocks the application of later rules within the same schema. We omit from this list the lexical rule, (26), which forms the dependent stem in /-m/ of some Nouns.

1. THEME formation

(a) \[
\begin{align*}
+\text{Verb} & \left\{ \begin{array}{l}
+\text{Obv} \\
-\text{Obv}
\end{array} \right. \\
-\text{me} & \left\{ \begin{array}{l}
+\text{me} \\
+\text{you}
\end{array} \right.
\end{align*}
\]

\[ [+\text{Verb} \ 1 \ [2]] \rightarrow [+\text{Noun} \ 2 \ [1]] \]

\[ /X/ \rightarrow /Xoko/ \]

(b) \[ [+\text{you}] \]

\[ /X/ \rightarrow /Xn/ \]

(c) \[ \left[ [+\text{me}] \right] \]

\[ /X/ \rightarrow /Xy/ \]

(d) \[ [+\text{Verb} [+\text{-me}]] \]

\[ /X/ \rightarrow /Xa/ \]

2. Prefixation

(a) \[ [+\text{you}] \]

\[ /X/ \rightarrow /kX/ \]

(b) \[ [+\text{me}] \]

\[ /X/ \rightarrow /nX/ \]

(c) \[ [+\text{Pl}] \]

\[ /X/ \rightarrow /wX/ \]
3. **TI Suffixation for non-first plural Subjects**

\[
\begin{array}{c}
+ \text{Verb} \\
- \text{me} \quad [\quad - \text{Anim} \quad ] \\
+ \text{Pl} \\
\end{array}
\]

\[
/X/ \rightarrow /X_{na}/
\]

4. **Suffixation**

(a) \[
\begin{array}{c}
+ \text{Noun} \\
+ \text{me} \quad (X) \\
+ \text{Pl} \\
\end{array}
\]

\[
/X/ \rightarrow /X_{nan}/
\]

(b) + me  
+ Pl

\[
/X/ \rightarrow /X_{mun}/
\]

(c) \[
\begin{array}{c}
+ \text{Pl} \\
- \text{me} \\
+ \text{you} \\
\end{array}
\]

\[
/X/ \rightarrow /X_{wa}/
\]

(d) + you  
+ Pl

\[
/X/ \rightarrow /X_{m}/
\]

(e) \[
[ + \text{Verb} \quad [ - \text{Anim}] ]
\]

\[
/X/ \rightarrow /X_{n}/
\]

(f) \[
\begin{array}{c}
+ \text{Verb} \\
- \text{Anim} \\
+ \text{Pl} \\
\end{array}
\]

\[
/X/ \rightarrow /X_{to}/
\]

(g) \[
\begin{array}{c}
+ \text{Verb} \\
- \text{Anim} \\
+ \text{Obv} \\
\end{array}
\]

\[
/X/ \rightarrow /X_{n}/
\]

5. **Outer Suffixation**

(a) \[
\begin{array}{c}
+ \text{Verb} \\
+ \text{me} \quad [ \quad ] \\
+ \text{Pl} \\
\end{array}
\]

\[
/X_{mun}/ \rightarrow /X_{mun}/
\]
(b) \[
\begin{array}{c}
- \text{me} \\
- \text{you} \\
+ \text{Anim} \\
+ \text{Pl}
\end{array}
\]

/\text{X}\(/ \rightarrow /\text{Xk}/

(c) \[
\begin{array}{c}
- \text{me} \\
- \text{you} \\
\{ + \text{Pl} \} \\
\{ + \text{Obv} \}
\end{array}
\]

/\text{X}\(/ \rightarrow /\text{Xn}/
7 Morphology in the lexicon: derivation

The place of the lexicon in relation to other components of a complete morphological description is implicit in much of what has already been said above. In particular, from the discussion of the word- (or stem-) based nature of morphology, and of the interaction of morphology with the syntax, the broad outlines of a possible internal organization for the lexicon are fairly clear. However, it is first necessary to say a few words about the notion of 'lexicon' itself. We suggest that this is properly construed as a component of linguistic knowledge (parallel in this respect to syntax and phonology), rather than merely as a list of arbitrary items. We then proceed to consider an important class of rules that characterize much of a speaker's lexical knowledge: the traditional domain of derivational processes. Finally, we discuss the issue of productivity, which bears in important ways on the status of particular lexical rules within the grammars of individual languages.

7.1 The lexicon

As Aronoff (1988) points out, there are a number of distinct senses that can be (and have been) assigned to the notions 'lexicon' and 'lexical.' Two of these are the principal concerns of Aronoff's discussion: the notions of the lexicon on the one hand as the locus of idiosyncrasy in language, and on the other as a collection of all of the items that belong to 'open' or 'major' word classes (typically Nouns, Verbs, and Adjectives).¹

The first of these conceptions is usually associated with Bloomfield, who says that

A complete description of a language will list every form whose function is not determined either by structure or by a marker [a 'function word,']

¹ A third notion of 'lexical' (or 'the lexicon') is not discussed by Aronoff: this is the notion of the lexicon as the scope of the 'Lexical Phonology' (in the sense of Kiparsky 1982a), as opposed to the domains of other phonological processes characterized as 'post-lexical.' We postpone discussion of these phonologically motivated distinctions until chapter 9 below, and ignore this possible interpretation of 'the lexicon' in the present discussion.
or closed-class item characteristic of some grammatical structure); it will include, accordingly, a *lexicon*, or list of morphemes, which indicates the form-class of each morpheme, as well as lists of all complex forms whose function is in any way irregular. (Bloomfield 1933: 269)

The ‘morphemes’ of a language appear in its lexicon because they constitute (by definition) irreducibly arbitrary associations of form and meaning. Larger constructions containing several morphemes appear to the extent their properties are not entirely those that would be projected from those of their components together with the rules of the grammar. If this notion is taken literally, the lexicon in this sense

is incredibly boring by its very nature. It contains objects of no single specifiable type (words, VPs, morphemes, perhaps intonation patterns, and so on), and those objects that it does contain are there because they fail to conform to interesting laws. The lexicon is like a prison – it contains only the lawless, and the only thing its inmates have in common is lawlessness. (Di Sciullo and Williams 1987: 3)

In contrast to this notion, Aronoff shows that the notion of the lexicon as an inventory of “Members of a Major Lexical Category” is presumed in much writing on generative grammar. Evidently these two conceptions are not co-extensive: on the one hand, some idiosyncratic items (including both members of the set of grammatical items like Determiners, Pre- or Postpositions, etc.; and idiomatic phrasal constructions) are not members of open word classes; and on the other, many words that are members of the classes Noun, Verb, and Adjective (or whatever the correct set might be) will, in many languages, be completely compositional formations composed of more than one minimal sign, such as *uninterpretability*. The *a priori* interest of the lexicon defined in this way, also, is not self-evident.

What these two ways of construing the notion of ‘lexicon’ have in common is that they are both kinds of list. Perhaps by analogy with dictionaries in the real world (which are, of course, lists of the words and other elements of a language together with information about their form, meaning and use), it seems often to be taken for granted that the lexicon is a kind of set or database.

Now of course no one would take seriously the notion that the ‘syntax’ of a language is a list of its sentences (whether the unpredictable ones or all those of some given type), or that the ‘phonology’ is a list of sound combinations. Both of these aspects of grammar are generally construed as kinds of knowledge speakers have about their language: in the one case, knowledge of the patterns by which words can be organized into larger structures, and in the other knowledge of how sound units of various sorts combine and the modifications they undergo within such larger combinations.
It seems productive to interpret the 'lexicon' of a language in a similar sense as, roughly, "the knowledge a speaker has of how words can instantiate (or in the usage of previous chapters, interpret) positions in a syntactic structure."

When construed as a form of knowledge, the lexicon is not necessarily just a list of items. Of course, much of what we know about the words of our language does have the character of individual and rather local stipulations, like "cat is a Noun pronounced /kæt/ and meaning 'a carnivorous mammal (Felis catus) long domesticated and kept by man as a pet or for catching rats and mice).'' But in addition, a speaker's lexical knowledge must also include a system of rules, which are ways of relating words to one another, insofar as these relations are (at least partially) systematic and thus part of our knowledge about words. Rules are also implicated in describing the formation of new words not hitherto part of a speaker's explicit knowledge of the language but implicit in its principles of word formation. In fact, even when a language has a rich set of general principles for forming new words, it is typically the case that the question of whether or not a given possible word is also an actual one remains a lexical issue. We might actually achieve a kind of typology within the lexicon by thinking of individual stipulated items (like the lexical content of cat) as constituting a kind of especially specific 'rule,' though we take no stand here on the content or desirability of that move.

It is not immediately clear that a notion of 'lexicon of language L' in the sense of 'the set of words of L' is conceptually well formed, or that it is particularly interesting even if so. Given potential sound/meaning correspondences, speakers can assign interpretations to these, such as "a word of my language that I have heard before," "a word that I can't recall having heard, but which probably means [such and such]," "a word I've heard before, and that has something to do with a part of a boat, but I don't really know what part," "a word I don't know that sounds like it has something to do with [such and such], but I can't tell exactly what," "surely not a word of my language," etc. These are all aspects of the set of principles a speaker has, and it is arguably the study of those principles that ought to be primary in the study of lexical knowledge. It seems quite unlikely that any particular list of specific forms, however annotated, can be formulated so as to express the same information. The fact that much of our knowledge of the lexicon is rather specific to individual words may seem to give it such a list-like character overall, but this is probably illusory. Many of the same problems arise in studying the lexicon from the point of view of its extension (i.e. as a list of

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2 This move is made in Kiparsky 1982a in order to achieve a unitary statement of the principles of disjunctive ordering.
words) that arise in studying other aspects of language extensionally (i.e. as "E-language" in the sense of Chomsky 1986b) rather than as systems of knowledge ("I-language" in Chomsky's terms).

The knowledge that speakers have of a language's lexicon probably applies over a superset of both of the notions discussed by Aronoff. Idiosyncratic things that speakers know about particular words are certainly 'lexical,' as are the properties of idiomatic units larger than the word (since particular words have distinct properties, known to the speaker, when instantiating positions within such a larger structure). Similarly, the lexicon comprehends our knowledge of the words that can fill major lexical categories, whether these are related in completely (or only partially) compositional ways to 'simpler' words or are themselves irreducible lexical primes. But while both of these kinds of knowledge can be presented in the form of lists, no particular list should be taken to exhaust the content of the knowledge that is the lexicon. For instance, speakers can certainly apply their knowledge to provide analyses of parts of unfamiliar potential words, analyses that may be insufficient to assign a structure to the entire word (just as, in syntax, speakers may be able to assign structural descriptions to only some parts of a sentence that is not fully grammatical). Central to our knowledge of language in this area, as in others, is the notion of rule-governed regularities, and their characterization as (in this case) Word Formation Rules.

Having just argued that the lexicon ought to be interpreted as a kind of knowledge governed by a system of rules (some of which may be highly specific), we will nonetheless adopt the common locution of speaking of word forms to which that knowledge extends as 'lexical entries,' and of particular forms as being (or not being) 'in the lexicon.' This should be interpreted in the particular sense that forms 'in the lexicon' are described directly by that component of the grammar (either by stipulative listing or by virtue of a rule or rules).

As we noted above in chapter 4, traditional grammars organize the discussion of morphological topics into the subfields of inflection, derivation, and compounding. The immediately preceding chapters have dealt largely with inflection, and following the framework outlined there, we will assume that productive morphological processes realizing syntactically relevant properties are described by a system of inflectional Word Formation Rules. Of course, insofar as some inflectional form of a word is (at least partially) idiosyncratic, knowledge of that form has the character of other specific stipulations. It appears to be the case, however, as discussed in previous chapters, that fully predictable aspects of inflectional form interact with the syntax and with other aspects of word knowledge in a particular way (formulated as principle (12) in chapter 5). We therefore assume that these inflectional Word Formation
Rules fall 'outside the lexicon' in the sense that they represent knowledge not of particular words, but rather of the form taken by words as a consequence of the syntactic structure in which they appear. This decision is largely terminological rather than substantive, though it seems to have some consequences in the differential ability of idiosyncratic (as opposed to productive) 'inflected' forms to serve as the basis of other formations, as we will see in chapter 11 below.

If we take the morphological aspects of inflection in this sense to be characterized as in chapter 5, we are left with the traditional domains of derivation and compounding to describe. These are, in fact, often grouped together in some traditions as 'word formation,' and we assume that both (understood presystematically) constitute sources for lexical stems that can interpret positions in a syntactic structure. There appear to be significant differences in the principles governing these two sources of words, however, and we will discuss them separately here. Chapter 11 will discuss the formation of compounds and its place in the study of grammar. The present chapter is concerned with the broad character of rules of derivation, in the classical sense: rules that operate within the lexicon to relate stems (in the sense in which we have used that term in previous chapters) to one another, and to create new lexical stems on the basis of existing ones when required.

### 7.2 Derivational rules

From the remarks above, it will be seen that in the present context, 'derivation' refers to the operation of a class of Word Formation Rules within the lexicon: specifically, those Word Formation Rules whose structural descriptions do not involve a dependence on information contained in the Morphosyntactic Representation of the position which a word (either the input or the output of the Word Formation Rule) is to interpret. These rules may refer to (and manipulate) the lexical category, syntactic subcategorization frame, semantics and argument structure, etc. of the stems to which they apply. They also typically perform some phonological change such as the addition of an affix, though some Word Formation Rules make no change in the shape of the stem, in the case of 'zero derived' forms such as denominal *to hoe, to rake, to shovel*, etc. Of course, a derivational rule may also leave unchanged an item's semantics (as in the case of 'empty' derivation, such as the Mandarin *-er* suffix discussed in section 4.1.2 of chapter 4 above), or its syntax (in the case of 'syncategorematic' derivation).

The class of Word Formation Rules considered (explicitly) in previous chapters has consisted of operations which introduce inflectional material
7.2 Derivational rules

into the surface forms of words. An inflectional Word Formation Rule operates on a pair \( \{ \mathcal{S}, \mathcal{M} \} \) consisting of a phonologically specified stem \( \mathcal{S} \), together with any further lexical specifications associated with that stem; and the Morphosyntactic Representation \( \mathcal{M} \) of some (terminal or non-terminal) position in a Phrase Marker which is to be interpreted by (an inflected form of) that stem. The stem \( \mathcal{S} \) is either the result of applying a previous Word Formation Rule, or itself an item that is described directly in the lexicon. We will see in chapter 8 below that this notion extends naturally to the case of rules introducing (certain types of) clitics, in which case the 'stem' is composed of the phonological form of a phrase as constructed thus far by other rules (of syntax, morphology and cliticization).

The Structural Description of such an inflectional Word Formation Rule thus includes two sorts of specification: conditions on \( \mathcal{S} \) (e.g. the requirement that the rule may only apply to stems of more than two syllables), and conditions on \( \mathcal{M} \) (e.g. the specification that the rule applies to Nouns interpreting positions bearing the feature \(+\text{Ergative})\). The Structural Change of such a rule may involve not only affixation but also other phonological changes such as metathesis, substitution, deletion, etc. 'Affixation' itself is controlled by a limited set of parameters that specify where in a form the additional phonological material is placed, as we will discuss in chapter 8 below.

Formally, the derivational rules that operate within the lexicon have a certain amount in common with inflectional Word Formation Rules. Such a rule has several aspects:

(1) a. A formal Structural Description, specifying the class of input stems the rule can apply to and any additional conditions (such as membership in specified subclasses of forms);
   b. A formal Structural Change, specifying the alteration the rule performs in creating the phonological form of the derived stem from the form of the input stem;
   c. A Syntactic Structural Description and Change (e.g., \('[\text{Adj}] \rightarrow [\text{Noun}]'; \('[+\_] \rightarrow [+\_\text{NP}]')\); and
   d. A Semantic Structural Description and change (e.g. "PROPERTY" \( \rightarrow \text{"STATE of having PROPERTY"} \)

The differences between inflectional and derivational rules are thus in their substantive specification. On one hand, the Structural Descriptions of inflectional rules refer to properties of Morphosyntactic Representations, while the Structural Descriptions of derivational rules refer to the content of (classes of) lexical items. On the other, the Structural Changes of inflectional rules affect only their phonological form, while derivational rules typically also effect modification in an item's semantics and/or syntax as well.
Importantly for present purposes, the notion of a derivational Word Formation Rule within this program includes relations that may be only partially specifiable between words in the lexicon. In fact, the suggestions of Jackendoff (1975) along these lines probably represent as strong a position as can be maintained on the kinds of regularity described by lexical rules. On that view, a Word Formation Rule is actually a sort of 'redundancy rule' over the items in the lexicon, specifying the amount of independent information present in a given lexical entry — and only superficially a process by which forms are created. The words of the language are all part of its lexicon, as that term is used here: Word Formation Rules function to specify the partially (but not entirely) systematic relations that exist among these items. Insofar as a word's properties are entirely predictable from the rules, we can say that the amount of additional information carried by its lexical entry is minimal. Furthermore, if the existence of a word has never previously been manifested, but its properties can be entirely predicted, the rules can be employed productively to make it available in the lexicon. In the general case, however, Word Formation Rules exist to specify partially systematic relations among lexical items rather than to carry out active 'derivation.'

7.2.1 The English -able rule
It is obviously well beyond the scope of the present chapter to survey all of the functions performed by derivational rules in the languages of the world. Our concern here is simply to exemplify the formal characteristics of such rules. Fortunately, most of the points relevant to an understanding of their content and operation can be made in the context of studying a single instance: here, the formation of English words in -able/-ible. Our exposition is based on the points made by Akmajian et al. (1979: 118–125) and Aronoff (1976: 121–129).

The central cases illustrating the category under discussion here are words like breakable, movable, inflatable, etc. These are Adjectives, and are based on transitive Verbs: thus, *goable, *dieable, etc. are impossible. As a first approximation, we might formulate the rule as in (2) below.

(2)  \[ WFR: [X]_v -> [X_ab]_{Adj} \]
    \[ Condition: [X]_v \text{ is transitive (i.e., } [+\_NP]) \]
    \[ Syntax: 'Object' argument of [X]_v \text{ corresponds to 'Subject' of } [X_ab]_{Adj} \]
    \[ Semantics: 'VERB' \rightarrow 'capable of being VERBed' \]

In its most complete form, then, a derivational Word Formation Rule constitutes a mapping between the phonological, syntactic, and semantic properties of one set of lexical items and the corresponding properties of another set. This is a fairly straightforward generalization of the traditional
notion of the 'morpheme' construed as the unity of a set of phonological, syntactic and semantic properties: in particular, it accommodates cases in which some component of a morphological operation is not purely additive in its effect on the properties of the resulting form.

In the following paragraphs we will survey a variety of ways in which the formulation in (2) does not describe the facts of English words in \( {-\text{able}} \) correctly or completely. Each of these difficulties provides an opportunity to explore the mechanisms of derivational morphology in greater detail.

**Truncated bases**
The first problem that arises for our rules is the fact that some Adjectives in \( {-\text{able}} \) correspond not to existing Verbs, but rather to a shortened form of such Verbs: for example, navigable, demonstrable, formulable, etc. From existing Verbs such as navigate, the rule in (2) would produce navigatable, demonstratable, formulatable, etc. rather than the observed forms. In order to derive navigable, etc., it is necessary to assume that some additional principle provides us with a base equal to that of the observed Verb minus the final sequence \( {-\text{ate}} \). Aronoff (1976) assumes that this is the effect of a class of rules of **truncation**, such as (3):

\[
\text{(3)} \quad [\text{Adj} \ [v \ X + \text{ATE}] + \text{ABLE}] \rightarrow [\text{Adj} \ [v \ X + \emptyset] + \text{ABLE}]
\]

Note that this rule is completely independent of the introduction of \( {-\text{able}} \) itself. An alternative would be to formulate the \( {-\text{able}} \) Word Formation Rule so as to include the truncation as part of its structural change:

\[
\text{(4)} \quad [X(\text{AT})]_v \rightarrow [X\emptyset b]_{\text{Adj}}.
\]

The effect of this rule depends on the shape of the base to which it applies: if that base ends in the sequence \( /\text{AT}/ \) the ending is added to the portion of the base preceding \( /\text{AT}/ \); otherwise the ending is added to the entire base, as usual.

The choice between a truncation rule of the sort proposed by Aronoff and the incorporation of truncation into the formulation of the \( {-\text{able}} \) rule as in (4) involves two independent issues. The first of these regards the status of truncated instances of \( {-\text{ate}} \). Rule (4) refers simply to the phonological sequence \( /\text{AT}/ \) in stem-final position, while rule (3) stipulates in addition that this sequence constitute a morphological unit (as indicated by its surrounding + -boundary elements). Aronoff argues that truncation rules always delete

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\(^3\) This is intended to represent the phonological shape of the ending \( {-\text{ate}} \), assuming that a rule of Vowel Shift has not yet applied when the suffix \( {-\text{able}} \) is introduced. Different assumptions about the phonology of English or its interaction with morphological processes would lead to formulations that would differ slightly, but in ways irrelevant to the point being made here.
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Formatives before other formatives: thus, debate → *deballable, because the /AT/ in debate is not a separate formative. If this argument could be sustained, it would provide a good reason to assume that information about formative boundaries is still present in derived words, contrary to the general view of the present work. In chapter 10 below we will return to this issue in the formulation of truncation, and suggest that formulations not requiring reference to morphological structure are to be preferred.

The other issue raised by (4) concerns the question of whether truncation is a separate rule, or rather part of the change made by rules introducing affixes such as -able. One could perhaps argue for the separate-rule description by showing that the phonology of words like navigable requires the assumption that at an intermediate stage of their derivation they contain all of the material in a representation like /navigatabl/; the fact that no such argument appears to exist for any known instance of truncation would appear to favor the assumption that such representations do not arise, as presumed on the account involving rule (4) instead. Another argument that might be offered would be the observation that more than one affix triggers truncation of the same sequence /AT/, but this would not really be substantive unless it could be shown that the affixes triggering truncation fall into some (phonologically or morphologically) natural class, such that a unitary truncation rule would capture a generalization that was missed by simply listing the affixes involved. Again, no such arguments appear to exist, and we therefore assume that the direct expression of truncation as part of the structural change of truncating affixes should be preferred rather than positing a distinct class of truncation rules.

Suppletive bases

Further problems still arise from the assumption that a rule like (2) accounts for the class of English Adjectives in -able, even when this rule is modified as in (4). For example, the stem form that appears in such an Adjective is sometimes distinct from that of the related Verb in ways that cannot be expressed as truncation. Thus, from apply we get applicable rather than *appliable. Indeed, other Verbs ending in -ply show the same peculiarity (e.g. multiply/multiplicable); and Verbs ending in -ply have forms in -plie before other endings (e.g. application, multiplication). To accommodate this situation, we need a rule (or principle) of allomorphy, specifying that certain stems have special shapes in the presence of certain others:

\[
(5) \quad [\text{ply}] \to [\text{plie}] / \begin{cases} \text{ABLE} \\ \text{ATE} \\ \vdots \end{cases}
\]
There are a variety of ways of describing such allomorphy, ranging from a quasi-phonological rule of ‘re-adjustment’ to lexical suppletion within the lexical entries of individual Verbs or of a presumed stem “-ply/plie” but we have no evidence to support one formulation over another, and merely note the existence of the phenomenon at this point.

**Missing bases**

In some cases we find an Adjective in -able for which there is no directly corresponding Verb. Examples include *affable, capable, credible, eligible, possible, potable, probable, …* These words have the syntax and semantics appropriate to other Adjectives in -able, but there is no existing English Verb stem from which they could have been ‘derived.’

These forms illustrate the fact that Word Formation Rules have two sorts of function. On the one hand, as we have already seen, they serve (actively) to create new stems out of existing lexical material. On the other hand, they must also be presumed to serve passively in supplying an ‘analysis’ for existing forms. Recall the suggestion above that derivational Word Formation Rules are mappings between one (phonologically, syntactically and semantically characterized) class of lexical items and another. If we take this notion seriously, there is no reason to require that such a mapping be ‘onto’ rather than ‘into’ (in the mathematical sense): in other words, we might well consider that words can exist in the class that constitutes range of this mapping without a corresponding element in its domain that maps onto them. The rule thus delimits a class of forms which it can analyze (‘-able Adjectives’), and associates their form with a set of syntactic and semantic characteristics. Words like *eligible,* etc., are listed directly in the lexicon; the only role of the Word Formation Rule in such cases is to express the extent to which such words cohere with the rest of the English lexicon. They are therefore (in this aspect) similar to the Redundancy Rules of Jackendoff 1975.

**Syntactically inappropriate bases**

A very few Adjectives in -able, including *perishable* (“liable to perish”) and perhaps *agreeable* (“ready or willing to agree”), are based on intransitive Verbs. Actually, when one looks more closely at Adjectives in -able, some apparently unproblematic examples turn out to illustrate this class as well. Thus, *changable, spoilable,* and *variable* can indeed mean “capable of being (changed, spoiled, varied);” but they also have the sense of the corresponding intransitives: “capable of (changing, spoiling, varying).” Furthermore, some Adjectives in -able for which no corresponding Verb exists in English (e.g. *durable, viable*) have a sense that puts them in this class: “able to (last, live).” These forms appear to be isolated, in the sense that creation of new Adjectives
in -able from intransitive Verbs is in general impossible, although they match much of the Word Formation Rule. In particular, they share the phonology and much of the syntax and semantics of 'regular' Adjectives in -able related to transitive Verbs. We do not in general want to say merely that they fall within the range of the Word Formation Rule, however, since we also want to express the fact that these Adjectives are sometimes related to corresponding Verbs (perish, vary).

We can note that the posited relationship between these Adjectives and intransitive Verbs matches both the domain and the range of the rule in several respects. Initially, it looks as if the Syntactic part of (2) above is violated; but in fact we can reformulate that portion of the rule in an interesting way so that these forms too satisfy it. Recall that in the discussion of K"ak"ala in chapter 2 we saw that morphological rules can refer to thematic relations (a semantically based notion) rather than to grammatical positions like Subject and Object. Now in fact, the central relation in this system is that of 'THEME'; and (without going into the murky question of just how to define that notion) the 'THEME' of a given Verb is typically found in Direct Object position when the Verb is transitive, but in Subject position for intransitives. We could thus augment the syntactic condition in (2) ("'Object' argument of \([X]_v\) corresponds to 'Subject' of \([Xabl]_{Adj}\)") by saying also that "'THEME' argument of \([X]_v\) corresponds to 'THEME' of \([Xabl]_{Adj}\)":

\[
(6) \quad \text{NP [v-NP]} \rightarrow \text{NP [v-]}
\]

In these terms, the syntactic relation that obtains in pairs like perish/perishable is deviant only in that the THEME of the domain Verb corresponds to its Subject rather than to its Object.

The refinement of (2) proposed in (6) is actually necessary in any event, since apparently transitive Verbs like have, resemble and weigh (in the sense of John's thesis weighs five pounds) do not have corresponding Adjectives in -able. These same Verbs do not form passive either; both properties could be argued to follow from the fact that their 'objects' are not in fact their 'THEMES.'

It might be proposed that in the formulation of rules like (6), the arrow in Word Formation Rules ought to be replaced by a double-headed arrow. This would express the notion that these rules really describe relations between two classes of forms rather than a simple directional change from one to the other. This aspect of such rules might be taken as the source of 'back

\footnote{See Anderson 1977a for some discussion, though a number of alternative accounts of these facts have been proposed in the literature.}
7.2 Derivational rules

formation, such as the creation in English of the Verb *edit* from the Noun *editor* (itself from Latin *edere* "to bring forth" plus -tor "agent suffix"). We prefer to treat such back formation as a more sporadic process, however. Its mechanism is presumably as follows. Suppose we have a form that falls within the range class of some rule (say an Adjective in *-able* with appropriate syntax and semantics, such as *submersible*, for which there is no transparently related Verb). A speaker might then presume that, although he or she had never encountered a Verb from which this word could be derived by the *-able* rule, there ought to be one. If there were a Verb related to *submersible*, its form and content are easy to project: *submerse*, with roughly the same meaning as *submerge.* Such an inference is clearly distinguishable, at least in principle, from the direct application of a linguistic rule; and insofar as back formations can be seen as sporadic inferences of this sort, it is not necessary to treat derivational rules *per se* as being bidirectional in their basic character.

The relation between, for example, *perish* and *perishable* still does not entirely satisfy the proposed Word Formation Rule, since its syntax still does not completely conform to that of fully regular forms, but it comes closer. This suggests that the function of a Word Formation Rule in analyzing an existing word can be a matter of degree. In the case of *perishable*, both the formal (phonological) part and the semantic (including thematic) parts are satisfied, but the specifically syntactic requirement that the Verb on the left side be transitive is not. Thus, the rule (as it exists now) expresses a relation that includes a (largely but not entirely regular) connection between the two existing lexical items *perish* and *perishable*, without thereby sanctioning the creation of new forms of the same type.

**Categorically inappropriate bases**

In addition to the formal type on which we have concentrated above, there are also *-able* words whose base is apparently a Noun and not a Verb. Examples include *comfortable, peaceable, objectionable, reputable, horrible* (from *horror*), etc. Here Aronoff's analysis is to posit a second rule, by which

\[(N \; X) \rightarrow [\text{Adj} \; (N \; X) + \text{ABLE}]\]

Although this rule involves the same formal (phonological) change as the rule in (2), and shares with that rule the syntactic property of forming

\footnote{The attested Verb *submerse* reflects the original past participle of the Latin Verb *submergere*, but whether this apparent back formation in English arises on the basis of *submersible* or of *submersion* or some other form is not evident. The word is cited here to illustrate a path of possible development, not as a demonstrable instance of that development.}
Adjectives, it differs considerably in its semantics. In the case of denominal Adjectives in -able, the semantic relation is something like "(NOUN)" → "CHARACTERIZED BY (NOUN)."

The point of this observation is that the same phonological material (the same formative, on a view like Aronoff's that attributes considerable importance to the identity of such units) can be introduced by more than one Word Formation Rule. Consider the word fashionable, for example, which is ambiguous: it can mean either "conforming to current fashion" or "capable of being fashioned." This latter meaning is not very common, but neither is the Verb fashion "to give shape or form to." The two senses correspond to the operation of two distinct rules, rather than to some presumed ambiguity or vagueness in the output of a single unitary -able rule.

Apart from their semantics, the rules may also differ in their compatibility with other processes. Aronoff (1976: 48) argues that the -able Adjectives based on Nouns do not in general form nominalizations in -ability (cf. the absence of *comfortability, *peaceability, *horribility). Unfortunately, pleasurability, reputability, salability, serviceability and a few others arguably of this type actually are found in dictionaries. Note further the forms ability and (especially) stability, which suggest that the relevant rule for Nouns in -ability does not actually require that bases of the form [Adj Xable] be derived from some other root by means of an -able suffixation rule at all.

Multiple outputs from the same base
Some (Verb) bases yield more than one Adjective in -able. Examples include pairs such as navigable, navigatable; demonstrable, demonstratable; operable, operatable; separable, separatable, etc. See also pairs like divisible, dividable and multiplicable, multipliable, where the difference between the two forms is a matter of whether or not an idiosyncratic principle of allomorphy applies, rather than the presence or absence of truncation. Now the members of these pairs usually show two correlated properties: in essence, the form with the more transparent phonology also has more transparent semantics. Thus operatable is formed simply by adding the suffix -able at the end of the Verb operate, and means "capable of being operated"; while operable involves truncation of -ate and has the more idiosyncratic meaning "fit, possible, or desirable to do or use; or admitting of treatment by (surgical) operation."

In terms of the phonological theories of the 1970s, Aronoff proposed that these pairs involve two distinct suffixes (+able and #able*), differing in their phonology but not substantially in other properties. A later formulation, in

* See chapter 9 below for discussion of the historical use of distinct boundary elements like "+" vs. "#" to encode such differences in phonological effect.
terms of Lexical Phonology, would be that the -able rule can apply either at level I of the phonology (where it yields forms like divisible, operable, etc.); or else at level II, where it yields forms like dividable, operatable. This implies either that the 'fix-up' rules (truncation, allomorphy) involved in some of these forms apply exclusively at level I, or else that the level I and level II incarnations of the process differ slightly. On the latter view, this is another instance of two rules that make the same change, while the former interpretation raises the issue of how complex the interaction of a single rule with the rules of the (Lexical) Phonology can be.

Failure to note the fact that Adjectives in -able may display 'level II' phonology (combined with essentially compositional semantics) as well as 'level I' phonology (often with more idiosyncratic interpretation), sometimes from the same base, has led to confusion at various points in the literature, especially in the discussion of so-called 'bracketing paradoxes.' Our interest here is not in discussing that issue, but simply in pointing out that what is apparently the same Word Formation Rule (with slight variations, such as the presence vs. absence of concomitant truncation) can apply in more than one way with respect to the rules of the phonology.

Non-compositional forms
As is evident from examples already discussed above, some Adjectives in -able have meanings that are not totally compositional. Thus, comparable means "roughly equal," not just "capable of being compared," although this latter sense is the only one available for compàrable, the level 2 (or #able form). Similarly, tolerable means "moderately good or agreeable," and not (just) the same thing as toleratable ("capable of being endured, tolerated"). Many further examples of similar type exist, generally associated with 'level I' phonology. Generally the compositional sense exists as well, either associated with a 'level II' form derived from the same base (as in the examples above) or as an alternative sense of the 'level I' form (as with calculable "capable of being calculated" or "dependable, reliable," a level I formation as shown by the truncation involved in its relation to calculate).

The non-compositional forms here are instances of the fact that once something is registered as a word, it takes on (potentially, at least) a concomitantly independent lexical existence. As a result, it may drift away in various ways from either the shape or the sense that it had when originally created by Word Formation Rule. This is quite natural, of course: as a word, it is also a sign, and since (on the view espoused here, at least) the sign relation is a holistic one between a possibly complex form and its possibly complex meaning, it is not constrained by the relations between form and meaning of its originally constituent parts. This is a central point of Aronoff 1976: quite
possibly the first mainstream linguistic work since de Saussure 1974 to construe
the sign relation in a way close to that in which de Saussure intended it. The
longer a word exists in a language as a lexical item, the more various parts
of its structure may become idiosyncratic, so that eventually this structure
can become quite opaque from a synchronic point of view.

In these cases, the amount of a word’s structure that can be ‘parsed’ (and
thus ‘motivated’ from the point of view of the system of the language) declines
as a function of its lexicalization. But since the parsing function of Word
Formation Rules is passive and gradient (as suggested above), this is
presumably not contrary to what we should expect.

Opaque forms
The limiting case of such opacity is that of words like *personable*, *hospitable*,
and *roadability*, where the semantic relation to an underlying base (if indeed
there is one, as in the case of *formidable*) seems unique. In words like this,
the function of the Word Formation Rule is limited to allowing a parse of
its surface form as $[\text{Adj} \ [X]-\text{able}]$.

We conclude that Word Formation Rules have two distinct functions. On
the one hand, they serve to create new words out of the existing stock. On
the other, they serve to parse existing elements of the lexicon, relating (to a
greater or a lesser degree) the form and meaning of a given word to the
existence of other words with their own form and meaning. In the limit, they
may not relate an analyzed word to any other word at all, but merely record
its conformity in phonology, syntax and semantics with other words in the
range class of the function formalized or expressed by the Word Formation
Rule.

One could relate these two functions by taking the second one as basic.
On this picture, new words are formed by a process of free generation. Of
course, a word can only be used insofar as it is possible to determine its form,
its syntax, and in particular its meaning. There are only two ways to establish
what a word means. Either it is part of the speaker’s lexicon already, in which
case it can simply be looked up; or it is not, in which case it can be understood
by parsing it via the Word Formation Rules of the language and (thereby)
relating it to words that are already known.

This second mode also implies that speakers need not actually list in memory
those things about a word that are predictable from Word Formation Rules:
this is the sense of such rules as ‘Redundancy Rules.’ On the other hand, the
fact that this is not necessary does not automatically entail the conclusion
that speakers do not actually list some predictable facts about words. This is
an instance of a more general point about linguistic analyses: it is not obvious
that redundancy should be ruthlessly expunged from linguistic representation.
Generative linguists have often assumed (in part under the influence of information-theoretic conceptions of language: see Anderson 1985b for discussion) that a linguistic analysis must lead to completely non-redundant representations. There is no obvious a priori justification for this move, however, and (as Arnold Zwicky has pointed out to me) it is certainly not characteristic of other sciences, such as chemistry. The question of the balance between knowledge about language that is explicitly represented by speakers and what is retrieved on demand through the application of general principles is an empirical one. Speakers may well remember some things that could, in principle, be recovered by rule. That this occurs is perhaps suggested by the phenomenon of semantic drift mentioned above, an occurrence that suggests the independent lexical status of items that are (at least initially) fully implied by the morphological apparatus of a language.

7.3 Productivity and lexicalization

Among the questions that arise concerning the role of derivational rules in the lexicon is that of whether or not it is appropriate to specify individually (in traditional terms, to list) all of the words that are described by a Word Formation Rule, rather than considering them to be implicit in the set of unpredictable words that clearly must be specified, taken together with the set of rules. For instance, what is the correct treatment of patterns such as the one that makes Adverbs in -ly from Adjectives in English? Essentially any adjective has such a corresponding adverb, except for (a) Adjectives whose stems end in ly, such as silly; and (b) Adjectives for which a corresponding irregular Adverb appears in the lexicon (e.g. *goodly is not the Adverb corresponding to good because of the existence of well). Essentially by definition, it is necessary to identify those items which are in some way idiosyncratic. The possibility of omitting a word can thus only arise in the case of words formed by rules that are fully productive. But in that case, it is necessary to explore the question of what it means for a rule to be 'productive.'

The notion of productivity is often appealed to in the sense of the sheer number of forms accounted for by a given rule, but this is surely not a significant parameter of linguistic structure. What interests us is not how many forms exist, but rather how many of the ones a rule might predict to exist are real possibilities. Thus, both the suffixes -ment and -ion form Nouns from Verbs in English (detachment, inversion), but -ion only applies to Verb stems in the latinate class: cf. wonderment, settlement, amazement, etc., for which no corresponding forms in -ion exist. Since the latinate Verbs are a
proper subset of the total class of Verbs, it is misleading to take a simple
count of the number of -ion forms versus the number of -ment forms in
assessing the relative productivity of these rules.

The problem centers on what we should say about forms predicted to exist
by a given rule, but which are not in fact possible. An early approach to this
problem was that of Halle (1973). He allowed the rules to generate forms
freely, and then marked non-occurring forms in the lexicon with a feature
'[-LEXICAL INSERTION]'. While formally possible, such a device has little to
recommend it: aside from the extent to which it removes virtually all
constraints from the description, it is hard to imagine how a language learner
could ever acquire the fact that a given 'word' bears this feature.

Many non-occurring words can be blocked by conditions that are systematic
parts of the Structural Description of a rule. For instance, requiring a Verb
stem that undergoes the -ion rule to bear the feature [+LATINATE] will account
directly for the absence of *amazion, etc. Of course, if we have no constraints
on the inventory of features that can be appealed to in this way, this position
is not significantly more interesting than the use of [-LEXICAL INSERTION],
but this problem must be faced in any event, given the consensus among
morphologists that at least some (synchronically) arbitrary subdivisions of
the lexicon such as that between 'latinate' and 'non-latinate' forms in English
must be countenanced.

Sometimes the property of a rule's Structural Description which excludes
certain potential applications is a phonological one. Thus, we have causative
Verbs in -en from some Adjectives (e.g., blacken, redden, madden, quicken
etc.) but not others (e.g. *bluen, *ilacen, *pooren, etc.). As was pointed out
by Siegel (1974), there is a phonological generalization here: only monosyllabic
stems that end in an obstruent (preferably a dental) at the appropriate level
of their derivation are eligible to undergo this rule. Some other apparent
exceptions (*gooden, *badden, *muchen) which apparently do end in a dental
obstruent actually point to another fact about the rule: these are just the
Adjectives with irregular comparatives. In fact, when we look at the one
instance of such a comparative which itself meets the description of the
causative rule, we find it actually undergoes it: worse yields worsen, which
shows us that it is really the comparative and not the absolute form of the
Adjective which serves as the input to the rule. The ending -er is evidently
truncated when present before -en is added. The moral of this is that, once
the conditions on the Structural Description of a rule are completely
understood, apparent exceptions often turn out to be systematic.

7 The one other comparative which might be expected to undergo this rule is better. In
this case, the existence of better itself as a causative Verb blocks the formation of the
otherwise expected form *betten by disjunction, as described in the following paragraph.
Still other forms can be argued to be blocked by a semantically based extension of the principle of disjunctive ordering (e.g., *goodly “in a good way,” because of well; *cooker “person who cooks,” because of the existence of cook with that sense; cf. Kiparsky 1982b), but there remain words which are predicted but whose non-existence seems arbitrary. How are we to block, for example, *scrupulosity from scrupulous without an appeal to an arbitrary feature?

A proposal of Aronoff (1976) is to reduce the issue of productivity to that of compositionality. Any word whose properties can be exhaustively predicted from the properties of existing words together with the set of Word Formation Rules is implicitly possible, on this view, and its existence need not be further stipulated. Insofar as the Word Formation Rule is systematically incomplete, though, or the word has some idiosyncrasy of form, meaning, or syntax, it must be explicitly given in the lexicon. The more idiosyncratic a given formation is, the less information can be extracted in the formulation of a rule for it, and hence the less productive it will be. For instance, there are a number of English Adjectives with a prefix a-: afield, afoot, afire, abroad, ajar, aground, etc. It is quite impossible to add to this class, however – because, on this view, the sense of these formations is totally unpredictable. If a new form were created, the rule would give no information about how it is related to its base beyond its shape. This suggests that the accretion of particular, idiosyncratic senses attached to instances of a given formation leads to a state in which speakers (and language learners) trust it less, and thus its productivity reduces. It would indeed be quite elegant if the problem of productivity could be reduced in such a way, but this is still a programmatic goal rather than a demonstrated result.

7.4 Conclusion

The remarks above should give an outline of the nature of the lexicon as a component of linguistic knowledge, and of the basic properties of the Word Formation Rules governing derivational formations within the lexicon. There are, of course, many further questions of form and substance concerning the nature and operation of derivational rules. Many of these have been addressed in existing work: at least with regard to English, the literature on derivation is much more extensive than that dealing with other areas of morphological structure. It would take us much too far afield to deal with all of these points here, however, and we leave the account of derivation in the present skeletal state to pass on to other aspects of morphology.
8 Clitics are phrasal affixes

Now that we have outlined proposals for the treatment of inflectional and derivational morphology, we return to another problem which has already come up several times in previous chapters: the analysis of clitics. Clitics constitute the clearest *prima facie* challenge to the identification of phonological and syntactic notions of the word, since it is obvious that they represent the co-presence within a single phonological unit of two (or more) syntactically independent elements. The study of clitics has traditionally focused precisely on this apparently problematic aspect of their nature, assuming that clitics involve the association of distinctive syntactic properties with some phonological characterization.

We will suggest here, however, that this is not the right way to view the phenomena associated with 'clitics' in the languages of the world. It does indeed appear that there is a phonological characteristic associated with the root sense of 'clitic,' to wit, the property of being prosodically dependent on adjacent material. When we ask about the supposedly distinctive syntactic properties associated with clitic-hood, however, it will become clear that (a) not all phonological clitics have any syntactic properties distinct from those of corresponding non-clitics within a given language; (b) in at least some cases, the syntactic peculiarities of 'clitics' are found in the absence of the prosodic dependence which otherwise characterizes this class; and (c) the unusual distribution and placement of 'clitics' do not reflect the operation of unusual rules of syntax (in the usual sense), but rather represent a generalization of the rules of word-level morphology. The syntactic peculiarities of clitics will be seen to result from their introduction by a class of rules operating on phrases in the same way Word Formation Rules operate on words. The conclusion that there is such a class of rules, in turn, has significant consequences for the range of phenomena that are appropriately described by rules of the syntax.
8.1 The nature of clitics

Within the descriptive and theoretical literature, there are a number of distinct treatments that can be found for items classified pretheoretically as clitics. Many descriptions, for example, focus on the properties that divide clitics from other functionally parallel forms, and characterize them as distinct from the otherwise motivated lexical classes of the language. Treating clitics as occupying syntactically characterized positions, however, while not belonging to any independently justified lexical category, yields unsatisfactory accounts of their roles in linguistic structure regardless of how this is interpreted. Focusing on their differences from 'normal' lexical items, they might be treated as lexically isolated, not members of any lexical category at all. This is surely unsatisfactory, however, since there are clear uniformities of shape and positioning (varying from language to language) that are not accounted for if they cannot be associated with any category of linguistic objects. On the other hand, we might construe the formal regularities of clitics as evidence for their membership in some separate lexical category (like 'Particles') distinct from that of Nouns, Verbs, etc., a category which is characterized by more or less uniform regularities of form (such as lack of independent stress) and/or distribution (such as a specific location, like 'second position'). This emphasis on the formal correlates of clitic-hood, however, misses the fact that in terms of their syntactic function, many clitics are obviously well integrated into well-established lexical classes (such as the classes of auxiliary verbs, pronouns, and occasionally others).

On this basis, we would clearly like to be able to say (at least in many instances) that clitics are members of regular lexical categories, but still special: perhaps there is a feature '[± Clitic]' which distinguishes clitic and non-clitic words. In these terms, the function of a clitic serves as the foundation for its assignment to a lexical category, while its formal peculiarities serve to identify it as being, in addition, [+Clitic]. Unfortunately, this is still not sufficient, since the class of [+Clitic] elements in a single language may display more than one type of behavior, even within the same overall (functionally defined) category. For instance, in Kwak'ala, the Determiner elements within a single NP include both Determiner clitics that appear at the beginning of the phrase (and attach to a preceding word, as we saw above in chapter 2), and others that appear immediately after the first word of the NP (hence, in second position).

(1) la'mis-3k lal-gada yudax-3k q'altaxoyu
   AUX-3(near, visible) will go-these three-(near, visible) cut off
   "And so now these three pieces cut off will go"
Considerations such as these suggest that there may be no unitary solution to the problem of the lexical category status of clitics. But if that is the case, we might look for an account that did not assign them the status of nodes in syntactic markers at all. One possibility along these lines has also been suggested at various times in the literature: the notion that clitics are 'syntactic (or phrasal) affixes.' It is the purpose of this chapter to make this notion more precise, and to explore the analogy that can be drawn between affixation (or more generally, morphology) at the level of the word and cliticization phenomena at the level of the phrase. First, however, we review briefly the range of facts usually treated as involving clitics.

The dictionary (Morris, 1969: 430) tells us that an enclitic element is one "having no independent accent in a sentence and forming an accentual ... unit with the preceding word. Said of a word or particle; for instance 'em in informal English: Give 'em the works; or -que in Latin: Senatus populusque Romanus ('The senate and people of Rome')." The central property of clitics, then, is traditionally taken to be their lack of autonomous accentual properties. The two examples cited, however, represent somewhat different sorts of object from a syntactic point of view.

Recall that, in chapter 1, we distinguished (following in this respect the proposals of Zwicky 1977) between two types of clitic. A simple clitic is an element of some basic word class, which appears in a position relative to the rest of the structure in which the normal rules of the syntax would (or at least could) put it. The dictionary's example Give 'em the works is of this variety, since em corresponds to the full pronoun them, and appears in the same (post-verbal) position as other Indirect Objects in English, a position occupied by a Noun Phrase: cf. Give those three cute little bunnies the works. A somewhat more canonical example (because part of the standard language, rather than a phenomenon of 'informal speech') is the English reduced auxiliary -'s (= is or has) in LA's the place or LA's got North America's only Albanian restaurant. Simple clitics appear to be clear members of particular word classes (e.g. pronouns or auxiliary Verbs), parallel to non-clitic members of the same classes in their syntactic and semantic properties. The only respect in which they differ from other lexical items is that focused on in the dictionary's formulation: lack of 'independent accent,' with the consequence that they 'form a unit with the preceding word.'

In terms of current phonological theory, there is a fairly straightforward way to characterize this state of affairs. Much of the thrust of phonological

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1 'Proclitic' has a parallel definition, with the difference that proclitics form a unit with the following word.
2 This is almost true. It's called Ajetis, and it's in Hermosa Beach, but I've been told there are some others in other cities.
theory since the mid-1970s has been toward recognizing the fact that phonological (and phonetic) form is not simply that of a string of segment-sized entities: much additional internal organization is phonologically relevant. One type of such organization is the grouping of roughly segment-sized entities into larger constituents corresponding to prosodic domains such as syllables, feet, prosodic words, and phonological phrases. Suppose, then, that we say that (at least some of) this organization is present in lexical entries. If at least the fact that lexical items generally constitute phonological words is thus indicated, we can distinguish simple clitics from other lexical items by saying that the former are 'prosodically deficient' in that they are not assigned the higher-level prosodic category 'phonological word.' The consequences of this representation will then be two-fold: on the one hand, since the phonological word is the domain within which stress is assigned, no independent stress will appear on simple clitics. On the other hand, in order to be phonetically well-formed, it is clear that all phonological material must be integrated into the prosodic structure of utterances, which will entail the requirement that some rule incorporate the segmental/syllabic content of a simple clitic into a domain at each level of prosodic structure. As a result, clitics must be adjoined to material on one side or the other in order to become part of a word-level prosodic unit. The operation of incorporating such prosodically deficient material into a larger domain is generally referred to as 'stray adjunction' in the literature on metrical phonology, and is a process which is quite well motivated in the description of stress for reasons that are independent of the specific problem of clitics.

We assume, then, that a simple clitic is merely a lexical item whose phonological form does not include assignment to a prosodic unit at the level of 'word' (or some other appropriate unit that constitutes an essential domain of stress assignment). Individual languages will contain prosodic rules of Stray Adjunction, incorporating such material into adjacent word-level domains. Such rules may well be directional: if, for example, Stray Adjunction in a given language operates uniformly to adjoin such prosodic orphans to the domain on their left, the result will be a class of enclitics (while adjunction to the right yields proclitics). Of course other possibilities can also be envisioned: thus, the rule might be sensitive to syntactic structure in a cyclic fashion, so that while it can operate in either direction, it prefers to adjoin material within the minimal syntactic domain possible. A full study of such rules is beyond the scope of the present discussion: we mean only to suggest a characterization of simple clitics in terms of which concrete analyses can be framed.

In contrast with simple clitics, a special clitic is one whose position within some phrasal unit is determined by principles other than those of the non-clitic
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syntax. The dictionary's second example is an instance of this sort. In *Senatus populusque Romanus* the element *-que* conjoins "the senate" and "the people of Rome." The most syntactically 'natural' position in which such a conjunction could appear would be between the two phrases, as in *senātus et populus Rōmānus*. The element *-que*, however always appears after the first word in the last of a sequence of conjoined phrases. Since this syntactically unusual position is not one in which other, non-clitic conjunctions can appear, a special rule would appear to be needed to describe this distribution. In other words, not only is *-que* prosodically deficient (like simple clitics), it also appears to display a distinctive syntax. It is this latter property of clitics that makes them 'special.'

In fact, the range of types of special clitics seems to be quite narrowly limited. Following a number of surveys and discussions in the recent literature (including, but not limited to, Klavans 1980, 1985; Kaisse 1985; Nevis 1985; Sadock 1991) we can distinguish six possible ways in which the position of clitics can be determined by a special rule (other than the normal syntax of corresponding full lexical elements):

(2)  
   a. Initial clitics (e.g. K'ak'ala Determiners – Anderson 1984a).
   b. Final clitics (e.g. English -'s 'genitive').
   c. Second-position clitics (e.g. Warlpiri auxiliaries – Hale 1973b).
   d. Penultimate position clitics (e.g. Ngal̕kara [Australia] pronominals – Klavans 1985: 104f.).
   e. pre-Head clitics (e.g. Romance pronominal clitics, which typically attach at the front of the finite Verb; or before the infinitive if this is the only Verb).
   f. post-Head clitics (e.g. Finnish -kin 'unexpected', which attaches to the finite Verb of S – Nevis 1985).

Of these types, the first four are relatively uncontroversial. In addition, however, some clitics appear to attach to words of specific classes, rather than with reference to the beginnings or ends of phrases. By far the most common case of this sort is attachment to the finite inflected Verb of the clause, and we propose to describe this as attachment to the syntactic head of the clause (and by extension, potentially to other heads).

Assuming that the possibilities in (2) constitute an exhaustive typology of special clitics, we can use that fact to construct a theory of rules for the placement of these elements. In this, we follow the analysis developed by Klavans (1980, 1985) in characterizing clitic rules by the parameters in (3).

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3. Not counting certain prepositions, such as *ob* in, for example, *ob eāque rēs supplicātiō décrēta est* "and for these reasons a thanksgiving was decreed."
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(3) a. The clitic is located within some syntactic constituent (S vs. VS vs. NP, etc.) which constitutes its domain.
b. The clitic is located by reference to the {first vs. last vs. head} element of a specified sort within the constituent in which it appears.
c. The clitic {precedes vs. follows} this reference point.

Some clarification is necessary with respect to parameter (3b). What counts as the first (respectively, last or head) element within a domain may itself be subject to some variation. A classic example of this is the problem of enclitic placement in Serbo-Croatian (see Browne 1975), a language in which there is some variation possible between two interpretations of the principle governing clitic placement. On one of these, the first ‘element’ is the first phonological word; on the other, it is the first phrasal constituent. Thus, both of the sentences in (4) represent possible placements for the clitics mi ‘me’ and je ‘past.’

(4) a. Taj mi je pesnik napisao knjigu.
   that me PAST poet wrote book
   “That poet wrote me a book”
b. Taj pesnik mi je napisao knjigu.
   that poet me PAST wrote book
   “That poet wrote me a book”

A slightly different possibility is suggested by Kuipers (1974: 73), who says that in Shuswap “the interrogative particle -n ... always follows the first stressed word of the sentence.”

Klavans suggests that an additional parameter of clitic placement not among those in (3) is the choice of whether the clitic forms part of a phonological word with material on its {right vs. left}. We propose that this is not in fact a characteristic of individual clitics, but rather refers to the properties (and consequences) of a particular language’s rule(s) of Stray Adjunction. If this suggestion proves true, we can then say that the three choices in (3) by themselves provide a full description of the placement of special clitics.

The parameters of (3) specify the dimensions of possible variation in a class of rules placing linguistic elements, but note that nothing in this list depends in any way on the fact that those elements are ’prosodically deficient’ (the characterization we suggested above of the traditional sense of clitic). This suggests that placement by such a rule and lack of prosodic structure ought in principle to be independent of one another. We have already argued that this is the case in one direction: simple clitics lack the prosodic structure of independently stressed words, but are placed by ordinary principles of the syntax and not by a special rule of the class delimited by the parameters in
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(3). And in fact, exceptions also seem to exist in the other direction: elements placed by a rule of the sort associated with special clitics, but not lacking in prosodic structure.

The mere fact of bearing stress would not be sufficient to establish the prosodic self-sufficiency of a given special clitic. Klavans (1980) discusses various examples of clitic elements which come to bear stress by virtue of their position within some larger prosodic constituent. For instance, in certain dialects of southern Italy, a principle prohibiting stress further back from the end of a word than the antepenult results in stress being assigned to non-stem syllables in certain groups containing clitics, such as *sposāre=*sē=lla “marry=self=her; to get married to her.”

In addition, however, there are other cases in which we have no reason to believe that the members of a class of ‘clitics’ are prosodically unusual or deficient. These are instances of the sort of linguistic elements usually referred to (rather vaguely) in grammars as ‘particles,’ or at least that subset of ‘particles’ that have their own stress. For instance, consider the system of ‘clitics’ in Tagalog as described by Schachter and Otanes (1972). These elements (to which we will return below) include both Subject and Object pronouns and a set of ‘enclitic particles’ with adverbial or other sentence-modifying semantics; both types appear in a cluster following the initial element of the sentence (i.e., in second position within the clause). These Tagalog clitics do not appear to differ in their prosodic properties from other words. Stress in Tagalog is associated with (a) vowel length and (b) specific positions within an intonation contour, as determined by the length of words and the position of long vowels within a phrase. In both respects, clitics such as *tayo* [ta:yoh] “we (dual)” and *lamang* [la:man] “only, just” are completely parallel to other bisyllabic words with initial long syllables, for instance. Other instances of stress-bearing ‘particles’ located in some fixed way within a syntactic domain can be found in the literature, establishing that the lack of word-level prosody is neither necessary nor sufficient to condition ‘special clitic’ behavior.

We conclude, then, that traditional characterizations of items in particular languages as ‘clitics’ or ‘particles’ represent two distinct linguistically significant dimensions: (a) the fact that certain elements lack some of the prosodic structure (typically, the constitution of an autonomous phonological word) generally assigned to words in the language; and (b) placement by a special rule of the class characterized by the parameters in (3), rather than by the otherwise-motivated syntactic principles of the language. The two are independent, as we have seen, since prosodic dependence can be found either with or without special placement, and vice versa. Of the four types of linguistic element thus characterized (‘normal’ lexical items, simple clitics, special clitics
8.2 The nature of affixes

If the phenomena of cliticization and affixation are interestingly related, there ought to be parallels between the typologies of each domain. To explore these, we look now at the inventory of affixation types attested in natural languages. Of course, the commonest and most obvious types of affix are prefixes to whole words (e.g. English *re-* in *re-appoint*) and suffixes to whole words (e.g. English *-y* in *healthy*), categories which it is hardly necessary to defend in greater detail. This is by no means an exhaustive inventory of affixation operations, however.

Prefixes and suffixes are generally thought of as material added concatenatively to the beginnings and ends of words, respectively. In some instances, however, the location at which a prefix or suffix is added is internal to a “word” as it must be presumed to exist at the point the affixation in question operates. For instance, the structure of Icelandic ‘middle Verbs’ in -st is analyzed in considerable detail in Anderson 1990a, and will be discussed further below in chapter 11. Anticipating that discussion, these Verbs have an internal structure consisting of a Verb stem (generally the same as the stem of some non-st Verb) to which is adjoined the affix -st: thus, the stem of *kallast* “be called, named” has the form (5).

\[(5) \quad [v \quad [v \text{kall}]st]\]

Despite the fact that the verbal stem and the adjoined material -st incontestably form a lexical unit that exists prior to affixation registering, for example, the inflectional properties of particular forms, affixation (as well as other morphological operations applying to the structure in (5)) in fact applies to the verbal stem itself rather than to the whole word. Suffixation of */að/ “preterite” and */um/ “first-person plural Subject” yields (after subsequent application of the phonological rule of *u-umlaut*) *kolluðumst* “we were called, named,” a form with the structure in (6).

\[(6) \quad [v \quad [v \text{kolluðum}]st]\]
It appears, therefore, that in the case of words with internal structure such as that in (5), a rule of affixation may apply not to an entire word, but rather to an internal subconstituent that can be seen to be the structural head of the word. It might be suggested that in such a case, the application of the rule to an internal head constituent follows generally from some convention, rather than as a parameter of the individual rule. This does not seem to be the case, however, since certain other rules apply to the entire (complex) word. In Icelandic, the two -st Verbs with past participles that can show agreement in gender, number and case have the marker of this agreement added to the entire form as in (7).

(7) a. leggjast "lie down, go to bed"; p.p. masc. nom. sg. lagztur
b. setjast "sit down, take a seat"; p.p. masc. nom. sg. setztur

Similar examples can also be found in which the operation applying to a word's internal structural head is prefixation rather than suffixation. For example, Georgian Verbs with aspectual preverbs are unitary lexical items, but they contain an internal stem to which the preverb is adjoined. Operations of prefixation applying to Georgian Verbs with preverbs apply to the word-internal stem rather than to the entire word; thus, the first-person singular future form of [v mo[v klav]] "kill" is movklav "I will kill." Another example of the attachment of affixal material to a word-internal head constituent is supplied by the formation of denominal adjectives in Dutch when these are built on compounds: compare breed-ge-schouder-d "broad shouldered," where the affixal material /ge-...d/ is attached to the second, head member of the internally complex base form. We conclude, then, that rules of prefixation and/or suffixation can be specified to apply either to an entire word or to an internal structural head (insofar as these are distinct).

Prefixes and suffixes, even allowing for the possibility of varying domains within which these appear, are not of course the only sorts of affix to be found in natural languages. We also find affixes located in positions that cannot plausibly be argued to constitute the borders of a morphologically motivated constituent of a form: to wit, infixes, of which there are several general subtypes. A typical example is the element /-um-/ in Tagalog bumili

* The discussion here is based on surveys in the existing literature such as Moravcsik 1977 and Ullan 1975.
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"buy (actor focus)," inserted into the stem /bili/ (see magbili "sell"; ibili "buy for (someone)" etc.). The infix here appears in a position entirely surrounded by root elements: after the root initial consonant, and before the first vowel.

It is a matter of considerable interest, of course, to determine the principles by which infixes are (or can be) located within the stems that serve as their 'hosts.' Unfortunately, cases such as that of Tagalog /-um-/ leave this matter considerably underdetermined. In this instance, the affix might be located by a principle that puts it either (a) after the initial consonant of the stem, or (b) before the first vowel of the stem, as well as other formal possibilities. Since stem-initial syllables in Tagalog always begin with exactly one consonant (on the assumption that apparently vowel-initial forms actually begin with [ʔ]), these two descriptions are equivalent.

When we look at a wider range of languages, we find that each of the possibilities entertained in the preceding paragraph may turn out to be the correct one in a particular case. A number of Austroasiatic languages, for instance, make extensive use of infixes that are placed immediately after the first consonant of a word. For example, in Kamhmu\textsuperscript{6} we find an infix /-rn-/ "instrument" in forms such as hniip "spoon" (cf. hiip "eat with spoon"), crnok "gouging instrument" (cf. cok "to gouge"). When the stem begins with a consonant cluster, the cluster resulting from infixing /-rn-/ is simplified (e.g. krlam "pole carried on the shoulders" from klam "carry suspended from a pole"; crmool "dibble stick" from cmoool "make a hole with a dibble stick") or otherwise altered (e.g. cndrieh "comb" from crieh "to comb"). Nonetheless, it is clear that the placement of the infix is "following the first Consonant."

We might be able to describe this situation, in which an infix is placed after exactly one initial consonant, in either of two ways: (a) "place the infix after the first consonant"; or (b) "mark the first consonant as 'extrametrical' and attach the 'infix' at the left edge of the remainder of the word." This surely seems like a distinction without a difference, but in fact there are other sorts of infixation which do not seem to have a natural formulation on the basis of extrametricality. In Chamorro, for example (see Topping 1973) we find infixes similar to those in Philippine languages like Tagalog, including /-um-/ (cf. dumankolo "become big" from dankolo "big") and /-in-/ (cf. hinasso "thought (Noun)" from hasso "think"). In Chamorro, however, unlike Tagalog, we can find instances of these infixes in stems that begin with clusters:

\textsuperscript{6} This is a language of Viet Nam, for which the following facts are taken from Merrifield \textit{et al.} 1965 where they are attributed to William Smallley. Similar facts can be attested from a variety of related languages, such as Atayal, Semai, Temiar and Khasi.

\textsuperscript{7} We would of course like to know what happens when there is no initial consonant, but in this case (like so many others) language disappoints us. Judging both from the available forms and from the structure of related languages, there do not appear to be any vowel-initial stems in Kamhmu?.
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cf. trumisti “becomes sad,” trinisti “sadness,” both from tristi “sad”; plumanta “sets (the table) (nom. wh-agreement form)” from planta “set the table,” etc. Here the generalization appears to be that the infix is placed immediately before the first vowel of the stem, regardless of the number of preceding consonants.

What is interesting about this case is the fact that it would not appear to be describable in terms of extrametricality. That is because most versions of this notion in phonology constrain its operation so that exactly one metrical constituent of some type can be marked as extrametrical at the edge of a phonological domain. A sequence of one, two, or more onset consonants, however, does not constitute a metrical constituent of the right sort on most views; and so infixation of the sort illustrated in Chamorro could not be described as prefixation to a form part of which is extrametrical without weakening this notion.

Apparently, then, infixes may be located either after the first element of a form (for example, the initial consonant) or before the first element of a given type (e.g. before the first vowel). Other possibilities show that what sort of ‘element’ is relevant to such a statement is also subject to some variation, however. For instance, in Dakota infixes such as /-wa-/ /-ma-/ “1st person” in cawapca “I stab,” Pimaktomi “I am Iktomi” follow the vowel of the initial syllable. In this case, we might in fact formulate the process by invoking extrametricality, if we treat the infixes as being placed after the first mora of the word (where a mora consists of a single short vowel unit and any preceding consonantism). This would require us to treat a syllable like [?ik] as bimoraic, and we know of no evidence for the relevance of this unit in Dakota, but it is nonetheless a possible account. The choice between the formulations “mark the first mora extrametrical and add the infix at the left of what remains” and “place the infix after the first syllabic nucleus of the word” would have to be made on the basis of data from a language which had (unlike Dakota) a contrast between long and short vowels and in general a better established prosodic system.

The infixes we have considered thus far are all located with reference to

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8 I am indebted to Sandra Chung for supplying this information.
9 We might take forms like inipe? “thing cut” from ipe? “to cut,” umepanglo “to look for crabs” from epanglo “hunts crabs,” itself from panglo “crab,” as evidence that this generalization also holds when there are no initial consonants. Chamorro words that appear to begin with vowels, have an initial phonetic [ʔ], however, so we probably cannot conclude much from these cases.
10 We make no attempt to provide comprehensive references for this point. An early discussion is that of Hayes 1982; a more recent invocation of extrametricality for morphological purposes can be found in McCarthy and Prince 1990.
11 See Moravcsik 1977 for an extensive discussion of the facts of infixing in Dakota.
initial elements of some sort within the domain in which they occur. Other
infixes, however, are located with respect to other reference points. A classic
example is the Indo-European nasal infix, as in Latin *relinquō* “I leave” vs.
*reliquā* “I left,” which is introduced in the position preceding the final
consonant of the stem. Another possibility is the location of an infix preceding
a final syllable: for example, Hua (New Guinea) /-'a/- “negative” in *haru'apo*
“not slip” vs. *harupo* “slip” (see Haiman 1980).

Hyman 1990 describes a number of Bantu languages in which certain affixes
must be regarded as infixed before the last vowel of a Verb stem. One such
element can be taken from Luganda, for instance. The stem /-lōot-/ “dream”
can serve as the base of a causative formation /-lōot-j-/ “cause to dream,” in
which /t/ is palatalized to /s/ before /j/ to yield /-lōosj-/. To this base we can
further add /-agan-/ “reciprocal” or /-er-/ “benefactive”. These affixes,
however, are placed in the form before the last vowel to yield /-lōos-agan-j-/ “cause each other to dream” and /-lōos-er-j/ “cause to dream for/ at.” These
forms, in turn, undergo palatalization of the infix-final consonant before /j/
to yield /-lōosagañj-/* and /-lōosezj/, respectively. The fact that /-agan-/ and
/-er-/ are infixed in these forms is shown not only by the structure of their
meanings (in which the reciprocal and benefactive elements are clearly
additions to a base already containing the meaning of the causative), but also
by the phonological fact that palatalization induced on the root-final
consonant by the causative suffix /-j-/ is preserved after the addition of the
infix, which results in this consonant’s no longer being adjacent to the
palatalization-inducing vowel.

Infixes are generally described as being located with reference either to the
left edge of a word (or stem) or the right edge, but in at least some cases
infixed material appears to be located in a different way: with respect to the
syllable bearing the main stress in the word. In Shuswap (Kuipers 1974) a
consonant preceding the vowel of the main stressed syllable is copied after
the vowel to form diminutives and first-person verbal forms,12 in words like
pépsalk°e “small lake,” from pēsālk°e “lake”; sqēqxe “little dog” from sqēxe
“dog”; sapūpskn “I am hit in the face,” from the root /sap/ plus /-us/ “face,”
/-kn/ “first person”; cľxmsṭēm “I know it,” cf. cľxmsṭēs “he knows it”; qē?ce
“father,” yngēq페ce “my father.” On the other hand, the reduplicated material
which is added to form plurals in Samoan (see Churchward 1951) appears to
be inserted before the main stressed syllable, which in this language is generally
penultimate: thus, we find fofolō “swallow (pl.),” cf. singular fōlo; fa'amalolōsi
“encourage, force (pl.),” cf. singular fa'amalōsi; tutū “stand (pl.),” cf. singular
tū.

12 Politeness in Shuswap demands the use of the diminutivized form of the verb when the
Subject is first-person singular.
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From these facts, we can arrive at a characterization of how affixes can be placed by Word Formation Rules. The parameters in (8) constitute part of a theory of the Structural Changes of such rules, in that they indicate how a position within the input stem is identified where a specific change (generally, the introduction of phonological material corresponding to an affix) operates.

(8) Parameters for the placement of affixes within a word:
   a. The affix is located in the scope of some constituent which constitutes its domain. This may be either a morphological constituent (the word-structural head vs. the entire word) or a prosodic one (prosodic word).
   b. The affix is located by reference to the {first vs. last vs. main stressed} element of a given type within the constituent in which it appears.
   c. The affix {precedes vs. follows} the reference point.

With respect to parameter (8b), we should clarify the range of 'elements' which can serve in locating an affix. The 'anchoring' element must be a prosodic subconstituent at some level: segment, mora, syllable nucleus, syllable, or possibly foot. Once this element is identified, the affixal material is inserted in the form either preceding or following it.

The general approach being taken to affixation here, and many of its details, can be related to other proposals in the literature (e.g. Hoeksema and Janda 1988; McCarthy and Prince 1990; and much other recent writing), though there are differences of detail that remain to be justified or further explored. Our concern here is not with those details, however, since it seems likely that however they are resolved, the comparison between the parameters of affixation and of clitization which is our main interest in the present chapter will yield essentially the same result.

8.3 Clitics as phrase-level morphology

From the preceding discussion, it should be clear that there are very substantial similarities between the principles governing the placement of clitics and those for the placement of affixes: in fact, the two sets of parameters appear to be identical in their essence. Prefixes and suffixes obviously correspond to initial and final clitics. Languages like Icelandic and Georgian have internally complex words, with a non-head constituent (initial preverbs in Georgian, a final middle marker in Icelandic) and rules that assign affixes to the head stem rather than the whole word. This sort of choice (together, of course, with the choice of overall category to which affixation operations apply) corresponds to the choice of a syntactic domain within which clitics are located (as, for
example, the choice between NP clitics, VP clitics, and S clitics). Infixes constitute an analog to second-position and similar clitics: Tagalog -um- in *gumabi* "get on toward night-time" (cf. *gabi* "night") is located with reference to the first consonant of the stem, and follows this reference point.\(^{13}\)

A point that should be made about the degree of parallelism between (3) and (8) concerns the relation between clitics located with respect to the head of their phrase and affixes located with respect to a prosodic constituent bearing main stress. Neither of these situations is attested nearly as widely as more 'marginal' locations, but to the extent both are available options, we take each to be an instance of orientation with respect to a head. In the case of clitic placement, the domain within which the clitic is to be located has phrasal structure as assigned by the syntax, and it makes sense that the relevant notion of 'head' should be a syntactic one. Within words, on the other hand, there is no 'syntactic' structure,\(^{14}\) but there is of course a prosodic structure. Whether we choose to represent that by metrical trees (Liberman and Prince 1977) or grids (Prince 1983, and later literature), prosodic constituents bearing main stress are clearly the heads of their domains (on phonological, rather than morphosyntactic grounds). The only differences between (8) and (3), then, follow from the independently motivated difference between words and phrases as domains for the operation of rules.

Another relevant comparison between clitics and affixes is the following. As with clitics, affixes generally lack word-level prosodic structure (i.e., stress) of their own, but this is not always the case. To pick an example (almost) at random, Danish normally has stress on the initial syllable, though a large number of loans have different patterns. Suffixes are in general unstressed, and can be regarded as prosodically unstructured material which is incorporated into the base to which they are attached. The two suffixes *-eri* (as in *bryggeri* "brewery") and *-inde* (feminine, as in *skuespillerinde* "actress") bear stress: the first on its final syllable, and the second on its initial. In these cases the affixes must be regarded as constituting prosodically autonomous domains

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\(^{13}\) Or else, possibly, /-um-/ is located with respect to the first syllable nucleus, and precedes this reference point. As we have noted above, this choice cannot apparently be resolved in Tagalog, but other languages provide unambiguous attestation of each of these possibilities.

\(^{14}\) At least not on the line being defended here, and discussed in more detail in chapter 10 below. Of course, on an account by which 'morphemes' are arranged into a word-internal constituent structure (as proposed by those who construe morphology as 'word-syntax'), one might expect the relevant notion of head to be defined by the primitives of that structure. One might, in the extreme, expect to find affixes located by reference to the category-determining affix in an internally complex stem. The fact that no such placement of affixes occurs in natural languages could be construed as another argument (*ex silentio*) against assigning such structure to words.
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for the assignment of stress. Once again, we see that the properties of being introduced by a rule of a particular type and of lacking independently assigned stress, while commonly associated, are nonetheless distinct and separable in particular cases.

A final aspect of the similarity between clitics and affixes leads us to a generalization of the notion of 'special clitic.' Just as word-level morphology includes both affixation and non-affixal changes (vowel changes, consonant mutation, metathesis, deletion, etc.), phrasal morphology is generally affixal (for example, English -'s in I once knew that guy you're talking about's brother-in-law), but sometimes non-affixal. An example of the latter sort is provided by the "definitive accent" in Tongan (Churchward 1953). In this language, the normal location of stress is on (the syllable containing) the penultimate mora. A sort of definiteness is marked by a stress shift to the final mora of the entire NP. The examples in (9) show that the stress shift occurs only on the very last word of the NP.

(9) a. kuo maumau 'a [e sāliote]
PAST broke ABS. ART. cart-DEF.
"The cart is broken"
b. kuo maumau 'a [e sāliote 'a Feleti]
PAST broke ABS. ART. cart GEN. Fred-DEF.
"Fred's cart is broken"
c. kuo maumau 'a [e sāliote 'a Feleti mo Sione]
PAST broke ABS. ART. cart GEN. Fred and John-DEF.
"Fred and John's cart is broken"
d. te u 'alu ki [he fale kuo nau fakataha ai]
FUT. I go to ART. house PAST they assemble in-it-DEF.
"I will go to the house in which they have assembled"
e. na'a ke 'alu ki [he fakataha lahi] anaeafi
Q you go to ART. meeting big-DEF. yesterday
"Did you go to the big meeting yesterday?"

The Tongan definitive accent is discussed in the context of Lexical Phonology by Poser (1985), who shows that the change involved is deeply embedded in the phonology of the language. Poser raises (but does not resolve) the question of how the accent shift is to be represented phonologically. Given the general principle of penultimate accent in Tongan, words with the definitive accent can be seen as acting 'as if' they had an additional syllable; indeed, Clark (1974) argues that the phenomenon represents the reflex of an original demonstrative *a that would fill a gap in the paradigm of demonstrative elements in the language. Apparently, this element came to be assimilated to the quality of the preceding (word-final) vowel, and the resulting long vowel was then shortened – after having attracted the stress.
In modern Tongan, there is no evidence for a vocalic position marking the definitive accent except for the shift of stress itself. Any full vowel assigned to this ‘morpheme’ ought (counterfactually) to surface, and so no such representation is satisfactory. The alternative would be to represent the definitive accent as a clitic consisting exactly of a single melodically unspecified mora: an “empty V-slot,” in another terminology. This alternative too has problems, however.

In order for the “unspecified V-slot” analysis to work, we must ensure that melodic material does not become associated with this position, for if that happened we would derive a final long vowel rather than the stressed short vowel Churchward describes. Most accounts of autosegmental theory, however, assume that the association of such an unspecified slot with available melodic material (such as that linked to the adjacent word-final vowel position) takes place automatically by convention. We would therefore have to maintain that, in Tongan, no such association normally occurs; and since there is no explicit rule of association to cover the definitive accent case, the slot simply remains unassociated and thus is not phonetically realized except in its effect on the placement of stress.

This account is not satisfactory either, however, since other processes in Tongan require us to assume that melodic material does in general associate with available structural positions. There are several circumstances in which this occurs. First, a number of lexical items in the language appear to show a pattern of reduplication in which the first vowel of the reduplicated material is lengthened: e.g. māfima “Almighty,” cf. mafi “powerful”; lāngilangi “splendor, glory”; mānumanu “covetous,” etc. Such length alternations are sporadic, but suggest that the lengthening of a vowel can form part of a systematic relationship in word formation.

Second, Churchward (1953: 13) describes a pattern by which the Verb of a clause can be repeated to yield an iterated interpretation. When this happens, the stressed vowels of the repeated Verb forms are lengthened.

(10) a. Na’a nau kūmi kūmi ‘o ‘osi ‘a Tonga ni
   PAST they search (kūmi) search (kūmi) all over Tonga
   “They searched and searched and searched...all over Tonga”

   b. Na’e kāi kāi pea mākona, pea toe tangi
   PAST-he ate (kāi) ate (kāi) and was satisfied and again cried
   “He ate and ate and ate...until he had enough, and then cried again”

Third, the language in general requires lexical items (with the exception of a limited inventory of unstressed clitics and ‘particles’) to contain at least two moras. A small number of lexical items behave as if their lexical form violates this condition: underlying, they contain only a single mora. When such stems
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serve as the base of a longer word, the result is well formed, but when they do not, they must be augmented by the addition of another mora, resulting in a long vowel. One set of such forms includes ó “go (plural),” cf. omi “come (plural);” ū “sheltered,” unga “take shelter”; and pā “touch,” paki “touch momentarily.” Another set of forms is quite systematic: the demonstratives in (11).

(11) | Clitic | Pronoun | Locative | Adverb |
--- | --- | --- | --- |
| | ē | hē | pehē |
| | this | here | like this |
| | that | there | like that |
| ni | eni | heni | peheni |
| this | this | here | like this |
| na | ena | hena | pehena |
| that | that | there | like that |

The monomoraic clitic forms do not bear independent stress, and so are not subject to lengthening. The length alternations between ē, hē and the short stems that occur in the other forms follow from the rule of lengthening suggested above. The initial pe of the forms in the last column is originally the Preposition pei “like” (attested in related languages), and these forms can be regarded as lexicalized Prepositional Phrases containing the stems of the third column. It is apparent that the stems are /e/ and /he/: when followed by a clitic (/-ni/ or /-na/), the result is bimoraic, and thus remains unchanged, but otherwise the monomoraic form must be lengthened.

Poser (1985) suggests that these forms do not involve lengthening of a monomoraic stem, but rather a minor rule of shortening. His arguments for this analysis are (a) if pāaki “print” is derived from the same stem as pā “touch,” there is no way to derive the second a-mora in this form on the assumption the stem is monomoraic; and (b) long vowels in other derivatives, such as ūngaki “be sheltered from the wind” and fepā’aki “touch each other” would be similarly unmotivated. In each case, however, the argument is at best inconclusive. Paaki “print” is somewhat distantly related to pā “touch,” and probably represents a lexicalization of the sequence pā plus ki, an oblique Object-marking Preposition. That this lexicalization should proceed on the basis of the surface form is perfectly plausible. Ūngaki is an unusual form: it appears to be built on ūnga “take shelter” by the addition of -ki, which normally forms transitives. In any event, it is an isolated formation and may again be built on the surface form of ū “sheltered” rather than on its underlying stem, which appears in other derivatives such as ūnga’anga “place of refuge.” In the case of fepā’aki, we have no way of determining the source of the long vowel, since some other instances of this formation show lengthening of the corresponding vowel when there is no reason to doubt that it is basically short: cf. lele “run,” fелe’aki “run hither and hither”; hanga “to face,” fehāngaaki “to face each other,” etc. We conclude that there is no substantive evidence against the analysis that takes ó, ū and pā to be lengthened forms of underlyingly monomoraic stems.

These stems are arguably cognate with the unstressed monomoraic article e, he as well.
In each of these (and other, more marginal) cases we find vowels lengthened, presumably by the insertion of additional moras that are underlyingly unassociated with melodic material. But in each case, the inserted mora must be assumed to associate with the material linked to the adjacent vowel. This implies that Tongan generally does perform such associations, and so the phonological expression of the ‘definitive accent’ must involve some other mechanism than the simple insertion of an empty moraic position. On the view espoused in the present work, it is perfectly natural to propose that the definitive accent is associated with a Structural Change that alters metrical structure, shifting stress from the penultimate to the final mora directly. But since the location of this is determined as ‘at the right edge of the NP,’ it constitutes an instance of a ‘non-affixal clitic.’

Another example of this sort is found in Welsh. In this language, the first word of a NP used as the Direct Object of a finite Verb undergoes the ‘soft mutation.’ This consists in altering an initial consonant as indicated in the chart in (12).

(12) Basic consonant p t c [k] b d g m l l [l] rh
Lenited form b d g f [v] dd [U] f [v] l r

This sort of “chain shift” has no constant phonetic content, and thus cannot be regarded as affixation. Note that *contra* Liber (1983b), it is not possible to say that lenition is an affix consisting of [+Voice, +Continuant]. Even if one extended Lieber’s account to include the mutation of m, l, and rh, (but without affecting ff [f], s, and n), changes which do not fall under the same phonetic characterization, this account still will not suffice. If mutation consisted in adding the features [+Voice, +Continuant] to the initial segment, one would expect /p, t, k/ to become voiced fricatives (instead of stops). Lieber claims that voiceless stops do not become continuants because of their internal structure, but this is falsified by the fact that /p, t, k/ do become [f, θ, χ] by another, parallel change in Welsh: to wit, when they undergo the “spirant mutation.”

The effect of the Welsh “soft mutation” here is functionally equivalent to English case marking of, and constitutes an accusative case marker on the NP. As the examples in (13) illustrate, the mutation affects exactly the leftmost word within the direct Object NP.

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17 NP-initial vowels and those consonants not listed in (12) remain unchanged.
18 This may well be an over-simplified or otherwise incorrect description of the syntax of Welsh soft mutation, as argued for example by Harlow (1999). Regardless of that issue, however, it is relatively uncontroversial that the soft mutation in examples like (13) represents a property or effect applying to an entire phrase, but realized as a phonological change applying only to its left edge. In this sense it is entirely parallel to a phrasal clitic, except specifically for the fact that it consists of a non-affixational change.
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(13) a. Canodd y plant {ganeuon /y caneuon}.
sang the children {songs /the songs}
“The children sang {songs/the songs}”

b. Canodd y plant {gân /lawer cân /bump cân
sang the children {song /many song /five song
/y bump cân
/the five song
“The children sang {a song/many a song/five songs/the five songs}”

In an example taken from Zwicky 1984, we see that when the Object NP is a conjoined expression, the soft mutation effect extends to each conjunct (as we might expect accusative case marking to be distributed over conjuncts), except for the last where its effect is obscured by the fact that the conjunction "and" independently requires the spirant mutation to apply to the following element.

(14) Gwelodd y dyn gi, gath, a chog
saw the man dog cat and cuckoo
“The man saw a dog, a cat, and a cuckoo”

From these facts we conclude that the class of phenomena with the distributional properties of special clitics also includes some cases in which the formal marker involved does not consist in the introduction of an affix-like ‘particle,’ but rather involves a change that is best formulated as a process.

8.4 The formal expression of “clitic placement”

The previous section has focused on the formal relation between the expression of affixation (or, more generally, word-level morphology) and of special clitics. In essence, the two turn out to be quite parallel phenomena, differing only in their domain. Where ‘affixation’ (in an appropriately general sense) is normally thought of as a formal change applying to words, ‘special clitics’ can be seen as exactly the same sort of changes, as applied to the concrete form taken by larger syntactically structured expressions (phrases). There is a quite substantive claim involved, then, in the suggestion that special clitics represent ‘phrasal affixes.’ But the comparison goes beyond the merely formal.

In functional terms, word-level morphology represents the formal expression of the local properties of words – in the terminology of chapter 4, the inherent properties they have by virtue of their lexical identity, the properties they acquire by agreement or by virtue of their configurational position. A separate class of sources for morphological material is the system of derivational Word Formation Rules in a language, which reflect systematic relations within the lexicon by formal operations on word shape.
In addition to these functions indicated by morphological means, we also recognized a set of **phrasal** properties - properties of larger phrasal domains which determine the way these domains behave syntactically, but which are realized on particular words within the structure (e.g. the effect of tense etc. in defining the scope of binding relations). While phrasal properties are commonly realized in the morphology of specific items within those phrases, we suggest that in other cases they are realized by special clitics.

Consider the case of pronominal clitics, for example, a standard example of special cliticization in many languages. We propose that these are introduced by rules that constitute a natural generalization of the Word Formation Rules we have recognized in earlier chapters. Consider a rule introducing agreement marking on a Verb. At the word level, such a rule operates on a pair \{S, M\} consisting of the phonological form of the input word stem \(S\) in conjunction with the Morphosyntactic Representation \(M\) of the position to be interpreted by an inflected word. Let us compare this with the facts of a language (Warlpiri, for example) which has second-position clitics agreeing with the Subject and Object NP. These can also be treated as 'agreement morphology,' but this time introduced by a rule operating on phrases (specifically, in the current instance, clauses). Consider a representative Warlpiri sentence, as in (15).

(15) njuntu ka-rna-ngku kuyu-ku yilya-mi
you PRES-1 (Sbj)-2(Obj) meat-JUSSIVE send-NONPAST
“I am sending you for meat”

Let us assume that the syntactic structure of this sentence includes its Verb and the three arguments\(^{19}\) of the Verb. In the present instance, the first-person Subject NP is phonologically null (corresponding to the possibility of deleting unstressed pronouns in Warlpiri); the other positions are phonologically filled. Now recall that in chapter 5 above, we proposed that the mechanism of agreement is basically a matter of passing particular features within a syntactic structure, between the nodes representing phrasal categories and those representing the daughters of those phrases. Assuming the features of Subject and Object NPs are passed up to the higher projections of the Verb of which they are arguments, we accumulate at the clausal level a complex of features such as that in (16). We assume, as in previous chapters, that the internal organization of clauses, taken together with a cyclic principle for constructing agreement representations (example (14) of chapter 4) and the layering principle (example (12) of chapter 4), yields a representation on which Object features are hierarchically subordinated to subject features.

\(^{19}\) Or two arguments and an adjunct, depending on how kuyu-ku “for meat” is treated. This issue is irrelevant here.
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(16) [+S, +Present, +me, -you, -Plural [-me, +you, -Plural]]

Now in a language in which agreement is realized directly (and exclusively) on the Verb, agreement features such as those in (16) would be treated as head features, and thus inherited by the Verb of the clause (where they would be realized as verbal agreement morphology). In Warlpiri, however, there is no reason to believe that agreement is realized at all on Verbs per se. Rather, a set of rules of 'phrasal morphology' operate on the pair \{P, M\} consisting of the phonological form of the clause and the Morphosyntactic Representation (16) of the clause-level phrasal category. The first of these introduces the element /ka/ reflecting the feature [+Present]; subsequent rules introduce the affixes /-rna/ (as a reflection of the features of the Subject layer) and /-ngku/ (reflecting the features of the Object layer). Each of these rules performs its structural change at the position identified as after the initial word within the sentential domain.

The comparison between word- and phrase-level morphology (where the latter is interpreted as the system of special clitics) is sharpened when we realize that descriptions of clitics quite commonly distinguish two general sorts. One class represents basically 'grammatical' material, such as pronouns, tense markers, Determiners, and the like. The other class tends to have content that is often difficult to specify, but concerns notions that are broadly adverbial, or which relate to the relation between a given clause (or contained phrase) and other portions of the discourse of which it is a part. Roughly, then, we have (a) clitics that correspond to the syntactic structure and grammatical content of the phrase that constitutes their domain; and (b) clitics that introduce a modification of the meaning and/or discourse function of that phrase. This leads us to propose a systematic difference between two sorts of phrasal affix (or special clitic). But once we make this distinction, it can be seen as completely parallel to the much more traditional one between inflectional and derivational morphology at the level of the word.

(17) a. Derivational phrasal affixes correspond to the operation of rules that alter the semantic content (including whatever controls discourse function) of a phrase. Just as derivational Word Formation Rules map the semantics and syntax of their base onto that of their outputs, so these rules may effect a (non-identity) mapping from the compositional semantics of their input form onto a distinct interpretation associated

Notice that tense marking in Warlpiri involves two distinct sorts of morphology. On the one hand, verbal stems are characterized for one set of categories relevant to tense/aspect distinctions: these markers can be shown to have the properties of lexical or derivational morphology (see Anderson 1982: 590). On the other hand, a set of 'tense-marking auxiliaries' like /ka/ show the positional possibilities of clitics, and mark a distinct set of categorial distinctions. The interpretation of individual sentences involves combining the content represented by these two sorts of marker.
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with the form containing the clitic. These are the elements loosely called "particles" in common usage.

b. *Inflectional* affixes realize the 'Phrasal Properties' of their domain. These include auxiliaries, tense markers, and pronominal elements representing the arguments of a clause; and Determiners and possessive markers in NP. Like inflectional Word Formation Rules, these operate on a pair consisting of the phonological form of a phrase and the Morphosyntactic Representation constituted by the featural representation at the level of the phrase node (including features representing agreement within the phrase, or imposed on it by virtue of its position in larger phrases).

The intuition underlying this characterization is that both Word Formation Rules and Clitic Placement Rules are classes of functions, mapping the phonology, syntax and semantics of objects within a given domain (words/stems, phrases) onto the properties of other objects within that domain. These functions generally have a non-trivial phonological component and fall into two classes with respect to their other properties. One class (inflectional rules) treats the Morphosyntactic Representation of the syntactic position with which their operand is associated as part of their Structural Description, but makes no change in the syntax or semantics of that operand; while the other class (derivational rules) operates on the basis of the properties of the input form and effects some non-trivial change in its syntax and/or semantics.

The apparent formal and functional similarity between the two classes of clitic and two kinds of word-level morphology makes it seem worthwhile to ask just how far the comparison extends. And in fact, somewhat remarkably, when languages utilize extensive systems of both kinds of clitics at the same time, it seems to be the case that the 'inflectional' ones appear outside of (that is to say, after, if enclitic; or before, if proclitic) the 'derivational' ones. For example, in Ngiyambaa, Klavans (1983) argues that "particle clitics" systematically precede 'pronominal clitics,' as in (18). Here the first, innermost clitic (gara) represents a semantic function while the second and third (outer) clitics represent grammatical functions.

(18) warazy -gara -dhu -na
bad (STEM) "from sensory evidence" "1st NOM" "3rd ABS"
"I have apparently [made] it bad"

21 That is, they involve some change in the form of their operand, corresponding to the 'affix,' 'clitic,' or other formal change that is corresponds to their operation. Of course, some such rules may invoke the identity mapping in their phonology, corresponding to 'zero' affixes or clitics.

22 Since there appear to be instances of rules that are semantically and syntactically vacuous ('empty morphs'), as argued in chapter 3, the limiting case of a rule whose syntactic and semantic components are identity mappings must also be admitted.
The ordering of derivational material 'inside of' inflectional material in clitic systems is not limited to a single language, but seems to be quite general (insofar as the systems of inflectional and derivation clitics in a given language are comparable in ways that makes this question meaningful). Even in cases that appear not to conform completely to the generalization, an account is available that is consistent with it. Consider the case of Tagalog, for example (Schachter and Otanes 1972). This language has an extensive set of 'enclitic particles' encoding adverbial notions and falling clearly into the class we have referred to as derivation; and another set of enclitic pronouns, encoding arguments of the Verb and falling into the inflectional class. All of these enclitics appear after the first word of the sentence, but the classes are ordered with respect to one another.

The ordering is the following: (a) the monosyllabic pronoun clitics ko, ka and mo come first; (b) the derivational enclitic particles come next; and (c) all other enclitic pronouns follow all enclitic particles. At first glance, this appears to violate the principle under examination, since some inflectional elements (the monosyllabic pronouns) are 'inside' derivational ones. But let us examine more closely the rules that introduce the Tagalog clitics. Suppose we say that the clitic-introduction rules adjoin their phonological content to the host, rather than simply concatenating it. In that event, the result of adding, for example, the derivational clitic na "now" to a Verb nakikita "sees" will be the structure \( [_{v}v_{v}nakikita] na \). Suppose now that the rules introducing inflectional clitics apply to this structure. Most of these will simply adjoin their material to the right of this (sentence-initial) word. The rules introducing the three monosyllabic clitics, however, can be formulated to adjoin their material not to the entire word, but rather to its head, resulting in the structure in (19).

\[
(19) \quad \left[_{v}v_{v}v_{v}nakikita \right] ko \right] na \right] siya
\]

"I see him now"

The fact that all of the derivational enclitics are ordered uniformly with respect to inflectional enclitics can be interpreted as support for the general proposition under investigation here. The fact that some pronominal enclitics must appear attached directly to the host can be interpreted as a difference between head-of-word attachment and word attachment, and is not inconsistent with this proposal.

In addition to the general ordering of inflectional clitics outside of derivational ones, there is also a sort of cyclic principle at work in systems of clitic placement rules. The same word may host clitic elements derived from more than one domain; for instance, a sentence-initial Noun can bear
clitics both from its NP and from the S in which that NP appears. When this happens, the clitics associated with the 'inner' domain precede those associated with the 'outer' one. Consider the Ngiyambaa sentences (taken from Donaldson 1980) in (20).

(20)  
a. miri-lugu-baga:-dhu-nu: ŋa:raymiyi
dog-his-but-I-you showed
"But I showed you his dog"
b. wandan-gu-baɾa-nuŋ-gal buma-1-aga ŋa:-nhaːra-nuː-lu
wanda-ERG-surely-you-PL hit-θ-IRREAL see-if-you-he
"A wanda will surely kill you if he sees you"

In each of these sentences, the first word bears one (inflectional) clitic element representing a property of its NP, and both derivational and inflectional clitics representing properties of the containing sentence. As expected, these appear in the order NP clitic, sentential derivational clitic, and finally sentential inflectional clitic(s).

This observation (assuming it is confirmed by the examination of other languages) would follow directly from the rather natural assumption that clitic-placement rules apply in a cycle: that is, that rules operating on a given domain apply to a representation in which all included domains have already undergone whatever cliticization rules are relevant to them. On the other hand, the more general point that derivational clitic placement precedes inflectional has no obvious foundation in other principles. Recall that in chapter 4, we derived the corresponding result at the word level from the organization of the grammar and the different relations of derivational and inflectional rules to the process of lexical interpretation, an argument that does not extend in any obvious way to operations on phrasal structures. The parallel relation between derivational and inflectional operations at the levels of words and phrases, then, if true, suggests either that some more fundamental principle of grammar is at work in both instances, or else that our conception of the construction of phrases needs to be revised — a task for further research if ever there was one.

8.5 Conclusions

From the considerations in earlier sections of this chapter, we conclude that 'special clitics' are actually the 'morphology' of phrases, parallel in fundamental ways to the morphology of words. Uniformities across the class of affixes and clitics that we have seen are quite substantial. In particular, word-level and phrase-level 'morphology' share the same formal apparatus
Clitics are phrasal affixes

together (cf. (3) vs. (8) above; also (9)). Furthermore, they exhibit a shared difference between morphology accompanied by semantically significant operation on interpretation (derivation) and that marking syntactic properties of a structure (inflection). A point which we have not emphasized above, but which surely contributes to the conclusion that clitic placement and word-level morphology are parallel phenomena is the fact that the relative ordering of affixes and of clitics are typically both quite rigid, even in languages (such as Warlpiri) which otherwise have great freedom of order. In some instances, the relative ordering of clitics appears to be somewhat freer than that of affixes; but it appears that this is actually quite comparable to the situation in derivational morphology. If clitics represent operations on phrases, different sequences of these operations should correspond to different relative scope of the operations concerned. Insofar as the syntactic and semantic consequences of different operations are relatively independent (or mutually compatible in either order), we might expect to find both possibilities attested, just as we find, for example, both causative of reciprocals and reciprocals of causatives. Overall, the kinds of freedom available to clitics seem much more like those available in morphology than in syntax per se.

This is not, of course, the first time parallels between clitics and affixes have been suggested. The previous literature, however, has often focused on an attempt to find criteria for distinguishing one from the other, rather than on their substantial similarities. Some of the putative differences between clitics and affixes turn out either to be quite language specific, or simply to dissolve on further examination. For instance, Nevis (1985) proposes that clitics, but not affixes, can be borrowed. In fact, however, derivational affixes are quite commonly borrowed, as can be confirmed for example by a brief examination of the morphology of English, a Germanic language much of whose derivational apparatus comes from Romance. The example of borrowed clitics given by Nevis involves 'derivational' clitics (in the sense of the preceding section), and so does not serve to illustrate a difference between clitics and affixes.

The most extensive and detailed discussion of differences between clitics and affixes is that provided by Zwicky and Pullum (1983). We return to the specific example they discuss, that of the English negative element -n't, in chapter 13 below; for present purposes, and without recapitulating the entire content of their article, we simply enumerate in (21) the criteria they propose for making the distinction.

(21) a. Affixes are typically rather choosy about the stems they attach to, while clitics are much less sensitive to the properties of the word they group with.
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b. The set of words involving a given affix often involves arbitrary gaps, while arbitrary combinations of word plus clitic are not blocked.
c. Although affixed forms often show idiosyncratic phonological properties, phonological idiosyncrasies of specific word plus clitic combinations do not occur.
d. Affixed forms often show idiosyncratic semantics, while particular word plus clitic combinations do not.
e. Syntactic rules can (indeed, must) affect words as a unit, but not word plus clitic combinations.
f. Clitics can attach to material already containing clitics, but affixes cannot.

By and large, these observations seem completely correct. They do not, however, impugn the conclusion of this chapter that special clitics are to be seen as the phrasal analog of word-level morphology, or that the mechanisms appropriate to the description of affixation and of clitic placement are quite comparable (and quite distinct, in both cases, from the normal mechanisms of syntax). In fact, all of the properties enumerated in (21) relate to the fact that words, not phrases, are what appear in the lexicon; and that while phrases have internal structure from the point of view of the syntax, words do not. In fact, the properties in (21) are quite compatible with the notion that affixes and clitics are basically similar, given an organization of grammar such as that assumed in this work. 

23 Although there are some minor problems. For instance, with respect to (21d), we can note that arbitrarily lexicalized phrases containing clitics can in fact have lexical idiosyncrasies: cf. French il y a une souris dans ma soupe “There’s a mouse in my soup.”

24 The detailed proof of this proposition is left as an exercise for the reader.
9 The relation of morphology to phonology

Up to this point, our attention has focused primarily on the principles by which morphological material is introduced into words (i.e., the operation of Word Formation Rules) and on the interaction of those principles with the regularities of syntactic structure. We have as yet said little about the rules that directly govern regularities of sound structure or phonology. In this chapter, we discuss the interaction of word structure with phonology.

In the general domain of rules determining the phonetic forms of words, we can distinguish two broad classes: *Morphological* rules (i.e. Word Formation Rules, both inflectional and derivational); and *Phonological* rules. Morphological rules have a Structural Description referring to morphological material (either a Morphosyntactic Representation or an input lexical item), while phonological rules look exclusively at the phonological composition of a form. We have already seen (in chapter 2) that purely phonological rules have properties that are distinguishable from those sensitive to morphological categories – a conclusion that is probably uncontroversial for the set of clear Word Formation Rules that actually create the markings for such categories. We will suggest below the two sorts of rule may also have very significant similarities with respect to their Structural Changes, though that alone is no reason to doubt that the distinction is still worth making.

It is often assumed that there is an intermediate class, known as ‘Morphologically *conditioned* phonological rules.’ If these exist, they would be rules of the phonology which do not themselves mark a category, but which are nonetheless sensitive to its presence. On a view of morphology based on minimal sign morphemes, such rules must obviously be invoked in many cases: essentially every instance in which the ‘basic’ marker of some morphological property is accompanied by some other (not purely phonological) adjustment of phonetic form. With a shift in conception to a morphology based on Word Formation Rules, however, the motivation for such a class of mixed rules becomes much less secure. This is because it is generally possible to incorporate all of the phonological ‘side effects’ of a given category into the Word Formation Rule that creates the category in the first place. For example, an advocate of the notion of morphologically conditioned phonological rules might say that in German *Bäume* “trees,”
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from Baum "tree," we have a phonological rule of Umlaut (by which /au/→/äu/) which is triggered by the plural ending /-a/; but we can also say that in such forms, the rule for forming the plural does both suffixation and umlaut as part of a single (internally complex) Structural Change. An argument against this claim would be provided if it could be shown that the introduction of, for example, the final [-a] in German Bäume had to take place at one point and the change effected by Umlaut at a distinct stage of the derivation: that is, that some rule required access to a representation in which one of these changes had occurred and the other had not. Examples of this sort seem generally to be lacking, however, and we take this as an argument ex silentio for the position taken here. There are some non-trivial issues involved in this question, and further research is obviously called for to clarify the point, but we will simply assume that there is no need to recognize a distinct class of 'morphologically conditioned phonological rules' in addition to morphological rules and phonological rules.

If this conclusion is indeed correct, it is probably desirable to eliminate reference to morphological categories from phonological rules altogether. With this goal in mind, we begin by discussing the history of the role morphological information has been assumed to play in governing phonological regularities. In pre-generative phonological frameworks, this issue was discussed as the matter of 'grammatical prerequisites to phonemic analysis' or more generally in terms of the nature and status of information about 'juncture.' The idea of juncture was taken over in early generative frameworks as a system of quasi-phonological (but non-phonetic) boundary elements, and we summarize the role such boundaries have played in descriptions and the proposals that have been made to replace reliance on them by other devices.

In addition to the question of how much access phonological rules might have to non-phonological (in particular, morphological) information, another crucial issue in the organization of grammars is the way rules of the two types interact. The classical answer, as given in Chomsky and Halle 1968, is based on the overall structure of the grammar. On the view espoused there, the syntax constructs a lexically interpreted Phrase Marker containing all of the morphemes (hence, all of the formatives) that occur in the surface structure of the sentence. This representation is then subject to a class of re-adjustment rules, which effect idiosyncratic changes in the shapes of particular formatives in the presence of certain others. The output of the re-adjustment rules then serves as the input to the phonology proper. This organization thus requires that all of the rules determining the shapes of particular formatives (the morphology itself and the re-adjustment rules) come before all of the phonological rules.

Now in fact, a number of examples appeared in the literature after the
publication of Chomsky and Halle 1968 from which it was necessary to conclude that at least some phonological rules can apply before at least some morphological rules (see Anderson 1975, Dressler 1976, and others). If at least some of these examples are valid (and the number of well-established cases is by now quite large), it follows that the phonology and the morphology are intermixed to some extent. It is obviously undesirable to conclude from this, however, that there is simply one large collection of rules, morphological and phonological, whose interactions with one another are unconstrained by principles other than language-particular orderings.

The guiding intuition of the traditional view is that morphology (whether construed as a set of morphotactic rules that specify the set of well-formed combinations of morphemes, or as Word Formation Rules) serves to create new meaningful combinations of phonological material, while the phonology serves to ‘adjust’ the results of such combinations to the sound system of the language. But within contemporary views, the set of Word Formation Rules are taken (as argued above) to operate on words¹ rather than on minimal building blocks of words (morphemes). Since it is also words (not morphemes) that constitute the domain of the phonology, this suggests a revision of the picture as presented in Chomsky and Halle 1968. Where a Word Formation Rule produces a result which is subject to phonological adjustment, it would seem reasonable to say that it is in this adjusted form that the output of the rule becomes available as the input of other rules. If so, the interaction of rules is somewhat more complicated, but nonetheless constrained by the organization of the grammar. A set of phonologically adjusted forms constitute the lexical items of the language. These can serve as the input to Word Formation Rules; when they do, the result is submitted to the phonology for adjustment to create a new lexical item – which is in turn available to other Word Formation Rules, etc. In consequence, phonological operations will sometimes be found to have applied prior to the operation of morphological ones, precisely in the case where the phonological operation applied to the form which constitutes the base of the morphological process.

The model of Lexical Phonology and Morphology² is based directly on this insight: that much of the phonology operates together with the Word Formation Rules in such a cyclic fashion to define the class of lexical items

¹ Actually, as we have seen, on stems, but the difference is not significant at this point.
² See Pesetsky 1979, Kiparsky 1982a, Mohanan 1982, and other recent works; for a lucid overview, see Kaisse and Shaw 1985. More than one writer has observed that ‘Lexical Phonology’ is a notion that is much more in the eyes of the beholder than most theoretical ideas in linguistics. The number of mutually incompatible views claiming to be ‘basically, the theory of Lexical Phonology’ is quite remarkable. We must therefore serve notice in advance that the particular selection we make below of the ideas that should be treated as essential may strike some as abandoning the soul of the theory.
within a given language. We will therefore discuss in section 9.2 below the motivations for assuming such an interaction, and an organization of grammar that accommodates the known cases. We will adopt as our model a version of Lexical Phonology: in particular, one maintaining the cyclic interaction of morphology and phonology and 'strict cyclicity' but abandoning the 'Affix Ordering Generalization' and some other proposals that have been associated with this theory in the literature. On this basis, we will maintain that phonological rules do not need direct access to non-phonological (morphological) information. This conclusion will be generalized in chapter 10, where we will argue that morphological structure internal to words is in general unavailable to other rules, and that it should be dispensed with in favor of other accounts of morphological relations.

9.1 Boundary elements in phonological theory

To provide some perspective on the issue of how morphological structure appears to impinge on the principles that determine the sound shape of words, we begin with the uses that were made of non-phonological information in pre-generative phonology. In these theories, such information was generally represented as a characteristic of the boundaries between distinct morphological elements. Such an element of juncture was viewed in (American) structuralist theory as a phonological unit, on a par with segmental phonemes. It was evidenced primarily in its effect on allophonic variation in other segments.

Subsequent discussion of the notion of juncture in 'Standard Theory' generative phonology took over many of the basic suggestions of structuralist phonology without great change. In particular, we can note the persistence of the conception of junctures as phonological elements. Within classical generative phonology, junctures were assumed to be inserted by rule on the basis of surface structure. There was a certain amount of discussion of the difference between junctures that merely delimit the scope of a rule and junctures that condition the operation of a rule in more active fashion, leading to proposals that assigned (at least a subset of) concrete phonological features to junctural elements. Dissatisfaction with the conceptual status of boundary

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3 See Anderson 1985b, Aronoff 1980, Bloomfield 1933, Moulton 1947, Stockwell, Bowen, and Silva-Fuenzalida 1956 and of course other literature of the period for the proposals on which the present discussion is based.

elements led eventually to a search for ways to replace them: in particular, proposals were made to accommodate at least some of the facts previously formulated in terms of boundaries by conditions on the internal organization of the system of phonological rules.

9.1.1 Juncture in structuralist phonology

Structuralist discussion of non-phonetic influences on phonological form was motivated by examples in which segment types that are, intuitively, contextual variants of the same phonological unit nonetheless appeared to contrast if 'contrast' had to be defined in purely phonetic terms. A prominent instance that was the basis of much debate was the existence of apparent minimal (and near-minimal) pairs for German [c] vs. [x], such as the words in (1).

   b. Tauchen [tawcan] "little rope" vs. tauchen [ta:wxan] "dive"
   c. Frauchen [fra:can] "wifey" vs. brauchen [bra:wxan] "need"
   d. Mamachen [mama:can] "little mama" vs. stachen [sta:wxan] "stung"

Despite the existence of such pairs, phonologists have generally felt that [c] and [x] in German ought to be treated as allophonic variants, and sought a mode of analysis that would make this possible.\(^5\) In the early literature on phonemics, a path to such an account was provided by Bloomfield (1930: 28): "[x] (after [a, o, u, aw] of the same word) is merely a variant of the phoneme ç (in all other positions)" (emphasis added\(^6\)). The basis of this analysis is the claim that "German treats compound-members and suffixes with initial consonants as separate words with secondary stress ... hence the ç of the suffix -çen is treated as if it were in word-initial" (ibid.). On this basis, Bloomfield proposes that we must recognize a division between words internal to German compounds (including, as a special case, words including the diminutive element -çen which was originally a separate, compounded stem). Once we recognize this division, we can make use of the fact that the boundaries of an utterance surely do have a phonetic reality to argue that "sentence-initial, sentence-middle, or sentence-final ... differences ... are in many (or most) languages extended to word-initial, word-middle or word-final, - although the word is not in principle a phonetic entity" (ibid.).

The rationale for this analysis comes from the fact that in general, words do have a motivation that can be connected with phonetic properties. For Bloomfield (1933: 178) "A word is a minimal free form." Thus, we can derive

\(^5\) For a recent treatment of these facts in relation to principles of Lexical Phonology, see Hall 1989.

\(^6\) This and other quotations from Bloomfield 1930, as well as the title of the article, have been transcribed here from the IPA original that appeared in Le maître phonétique.
a basic notion of a domain "word" from the set of minimal free forms of a
language; but we also see that these words can be included in larger,
non-minimal free forms. On that foundation, we can structure the larger
forms into word-size domains on the basis of our knowledge of the minimal
words of the language, even though this structuring has no necessary direct
phonetic correlates. Once we have done so, however, at least some of the
statements of phonemic structure (distribution of phonemes and their phonetic
realization: the phonological rules insofar as these were articulated in an
account of the sort Bloomfield envisioned) may be relativized to the domain
of the word and to its boundaries.

In his methodological writing, Bloomfield put heavy (some would even say
heavy-handed) emphasis on observables as the foundation of theoretical terms
and statements, and his position on the possibility of appealing to such internal
word boundaries is not really consistent with this. On the other hand, this
duality is quite characteristic of much of his work: he often pursues a genuine
insight into what the right analysis of some phenomenon (e.g. the phonemic
status of German [c] vs. [x]) 'ought' to be without necessarily working out
all of its consequences for his positions on different issues.

In contrast, Pike (1947; see also Pike 1952) took the apparent correctness
of analyses like Bloomfield's as support for the position that phonological
analysis cannot proceed without taking grammatical structure into account.
On his view, the presence of 'juncture' (the boundary between one domain
and another) derives from grammatical structure, not from phonetic form.
Pike's examples involve juncture-delimited domains as the scope of
distributional limitations. Thus, he gives a detailed analysis of constraints on
successive vowels in Mixteco morphemes. The limitations that occur within
the morpheme are not valid for any phonetically defined domain, however,
since these can be morphemically complex.

Bloomfield, similarly, had given examples of distributional limitations
within (non-phonetic) word domains: German final devoicing he takes to be
word-final (Bloomfield 1930), even in, for example, Handlung [hantlun],
handlich [hantliç], etc. This role of boundaries in conditioning the distribution
of allophonic variants was certainly the commonest way in which they were
invoked, but Pike also recognizes that non-phonetic domains like the 'word'
may be the scope of prosodic properties, like intonation and stress contours,
and that a coherent analysis of these phenomena may be impossible without
access to such domains. In the conception he develops (and similarly, in what
Bloomfield assumes with rather less theoretical discussion), a 'juncture' is not
an object, but rather the frontier between two domains. The role of such
domains in phonological statement can take any of the forms in (2).
a. Distributional statements may be restricted to apply only within a particular domain (e.g. within a word or within a morpheme);
b. Distributional statements may be valid exactly at the edge of a domain (e.g. word-initial or word-final); or
c. Some (typically suprasegmental properties) may be assigned directly to a domain as a whole.

Missing from this list is another way in which domain boundaries were invoked in later work: rules referring to the occurrence of a specified juncture internal to a context. On Pike's (and Bloomfield's) conception, however, junctures are not items that can occur within strings of phonemic material, but rather principled limitations on how much of that material is accessible to phonological inspection at a given time. Apparently individual statements of distribution can be 'ranked' by the level of structure to which they apply, with the implicit convention that lower-level structure is invisible to higher-level statements.

Needless to say, other phonemicists attacked Bloomfield's position on this issue, since it was not based on observable phonetic properties. In the literature of the late 1940s and 1950s, though, this mostly appears in the form of criticisms of Pike. Pike had added an espousal of the central role of meaning in linguistic (even phonemic) analysis, and so (for this reason, among others) he was considered beyond the pale and fair game for attack.

How might we develop an analysis that allows Bloomfield's (apparently correct) analysis of German [c] vs. [x] without abandoning the idea that phonemic theory is based purely on phonetics plus distribution? This was a matter that preoccupied a number of later writers. First of all, since a phonemic representation is simply a string of phonemes (each of which can be related to some observable aspect of the phonetic form), the concept of juncture as domain boundary has to be replaced by the notion of juncture as a phoneme in its own right. Once these new phonemes are inserted in the string, the kind of statement given by Bloomfield and Pike can be replaced by context-sensitive rules that make explicit reference to the juncture elements.

But, in the spirit of the time that treated issues in linguistic theory as matters of methodology and epistemology, how are we to know where these junctural 'phonemes' appear? If we assume that linguistics has to start with phonetics, work its way up to phonemic representations, and only then say anything about grammar, we have to be able to find the junctures on phonetic grounds. So a substantial amount of effort went into showing that there really was phonetic evidence for junctures.

One kind of evidence might be the fact that junctures condition variants of other phonemes: the function of phonological variants occurring at a
boundary as Grenzsignale (see Trubetzkoy 1939). But this is obviously circular: the point is to find justification for putting in a boundary so as to condition variation such as that between German [c] and [x], so we cannot use the variation itself as the justification. Furthermore, this move leads to spurious analyses. Harris observed (see Aronoff 1980) that as a consequence of final devoicing in German, only [t] and not [d] can appear before the word boundary element 8. On this basis, you could always write [t] as /d/, eliminating /t/ (as distinct from /d/) altogether (though at the cost of having numerous internal occurrences of # that are completely spurious from a grammatical point of view).

Therefore, a phonetic definition had to be provided for juncture in its own right. A notable attempt to do this was made by Moulton (1947). He first notes a number of aspects of German phonology that seem to be conditioned by juncture: stress, aspiration, glottal stops before vowels, [c] vs. [x], etc. He shows that the 'right' analysis of German has to make reference to junctures (and not just to segmental phonemes). He then defines a phoneme / + / of 'open juncture' with “two allophones: at the beginning or end of an utterance it appears as a pause of indeterminate duration; within an utterance, it appears as a brief pause or, in free variation, as zero” (1947: 220).

It is not at all obvious that all of the places where Moulton professes to find / + / actually show even the potential for pause: ‘open juncture’ appears in foreign borrowings, for instance, when these have exceptional stress (e.g. papier [pa'pʰɪr]). Further, the notion of defining a phoneme in terms of potential and not necessarily actual phonetic properties (like pause) was exactly one of the things Moulton’s neo-Bloomfieldian contemporaries were taking Pike to task for.

In fact, most of these linguists were clearly uneasy with the status of junctures as phonemes, and tried to find serious phonetic definitions for them. One particularly rigorous attempt of this sort was that of Stockwell, Bowen, and Silva-Fuenzalida (1956), who identified a number of phonetic correlates of junctures in Spanish. Some of these can be treated as conditioned variation in other phonemes at (or near) juncture, but some (e.g. local variations in rate of phonemic production) are treated as properties of the juncture itself. We arrive at a conception of juncture as an element in the string of phonemes, but one whose properties may in part be distributed over other segments, in the same way as suprasegmentals (pitch, stress, etc.).

In the structuralist literature, there was general discomfort about the extent to which juncture phonemes were phonetically discoverable. Imagine for instance how one goes about identifying instances of Trager and Smith's (1951) phoneme of 'close juncture,' whose phonetic realization is precisely the absence of the possibility for pause! The point of more lasting significance
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is an ontological one, however. The original conception of a juncture was as a 'frontier' between regions. Now if you ask yourself how thick the border between California and Nevada is, it is clear that it isn't really an object with 'thickness' at all. When we draw a line on a map, however, there is a temptation to regard it as an object. The same thing is involved in moving from juncture thought of as the boundary between two domains to juncture construed as an element that occurs in the phonemic string to delimit the domains.

Once junctures came to be accepted in phonemic representations, though, there seemed to be no reason to stop at just one. In fact, phonemic analyses came to posit an inventory of junctures for a language (e.g. /+/, /−/, and /#/) corresponding conceptually to domains of various sorts (e.g. morphemes, stems, and words) but defined in terms of subtly different phonetic effects. The inventory of junctures was included homogeneously with the inventory of a language's other phonemes, encouraging phonologists to think of them as positive elements with their own properties. On this basis, it became natural to attribute to phonemes of juncture properties that no longer corresponded to plausible 'domains.' For instance, suffixes in K'ak'ala have one of three morphophonemic effects on the stem to which they are added, as illustrated in (3).

(3) Hardening: e.g. /qap + alud/ \(\rightarrow\) [qap'alud] "to upset on rock"
    Softening: e.g. /qap + is/ \(\rightarrow\) [qabis] "to upset on the beach"
    Neutral: e.g. /q3p + a/ \(\rightarrow\) [qapa] "(hollow thing is) upside down"

The differences among these three sorts of behavior do not correspond to different domains in any reasonable sense. But we could set up three different sorts of suffix boundary, differentiated in content and triggering distinct contextual effects.

Aronoff (1980) describes a similar situation in 'Nootka' as discussed by Harris. In fact, some of Harris's work combines the two views we have seen: juncture as determined by grammatical structure, and juncture construed as a phoneme in its own right. This is what results from the assumptions in (4).

(4) a. The segmental phonemes are organized into a grammatical structure;
    b. Rules insert juncture phonemes at grammatically determined boundaries within this structure; and
    c. The phonological rules per se apply to the resulting string of segmental phonemes with intercalated juncture elements.

Inserting junctures on the basis of grammatical structure, rather than only as attested by direct phonetic effects, was in line with Pike's claim that the

7 Note also that a Lexical Phonological description invoking level ordering would not assign these affixes to different levels, because they can be more or less freely intermixed in various orders.
analyst should write a space, or a hyphen, or whatever was used to delimit words (or other grammatical units) even when there was no phonetic correlate. In the references cited above, Pike also addressed the issue of just what categories should correspond to phonologically significant junctures: for example, he suggests that things like ‘words,’ ‘morphemes,’ ‘phrases’ and the like are acceptable, but that the analysis should not take ‘Nouns’ and ‘Verbs’ to correspond to distinct junctures, though he does not provide principled arguments for such decisions. A complete theory of juncture would clearly have to say something about just what grammatical domains are available.

Moulton, in contrast, was concerned to show that (4) was just the sort of thing he did not intend. For him, allowing grammar to determine the phonemic representation would have represented an illicit ‘mixing of levels.’ Along with other orthodox American structuralists of the time, Moulton was troubled by the suspicious coincidence that the junctures they claimed to be able to find phonetically usually came at grammatical boundaries; and so in order to show that they were not just introducing grammatical structure into phonemics, they highlighted cases where apparent junctures came at non-grammatically conditioned places, such as the grammatically irrelevant / + /s in exceptionally stressed loan words in German. These cases could be taken to show that the junctures were ‘really’ phonetic/phonemic phenomena, and not grammar in disguise.

As heirs to the American structuralist tradition of employing boundaries in phonological description, however, Chomsky and Halle had no such prejudice against letting grammatical structure figure in phonology. This was partly as a result of Jakobson’s influence, and partly as a general questioning of the kind of analysis that characterized American structuralism.* Thus, a picture like that in (4) seemed a good starting point in generative phonology, since it provides a maximally flexible, homogeneous way to refer to both segments and junctures in phonological rules while also representing the claim that the junctures encode (potential) grammatical influences on phonology. In the following section, we trace the role junctural elements had in the “Standard Theory” as it developed in the 1960s.

9.1.2 Non-phonetic structure in “Standard Theory” phonology
Within structuralist phonology, ‘juncture’ had to be (at least in principle) a segment-like element with real (if possibly quite subtle) phonetic properties, discoverable in phonetic structure and only incidentally (hah!) related to higher-level grammatical structure. Pike, on the other hand, posited no such

* See Anderson (1985b, ch. 12) for some discussion of the intellectual climate of early generative phonology.
distinct 'juncture' elements: for him, high-level structure per se was directly available to delimit the domains that constituted the scope of certain distributional regularities.

The first great triumph of the emerging "generative" point of view was the analysis of English stress given by Chomsky, Halle, and Lukoff (1956), which reduced the chaos of a large number of supposedly "phonemic" stress levels to a single distinction [± Accented]. Crucial to this reduction, however, was the fact that the phonological transcription contained not only segments but junctures: elements which (unlike the "segmental phonemes") "do not represent physical entities, but are introduced for the purpose of reducing the number of physical features that must be considered phonemic" (1956: 66).

However, "it is obvious that unless some more or less severe limitations is imposed on the use of junctures, there are many trivial ways of [arriving at a phonological transcription]." Recall as a potential instance of such abuse the example (due to Harris) of the possibility of representing German [p, t, k] as [b#, d#, q#]. To eliminate spurious analyses, Chomsky, Halle, and Lukoff propose that "junctures should be distributed in a manner that is significant on higher levels. Specifically, junctures should appear only at morpheme boundaries, and different junctures should correspond, by and large, to different morphological and syntactic processes" (1956: 67).

This means that junctural elements will always reflect grammatical structure. The juncture elements do not quite correspond to the claim that such structure is itself visible to the phonology, though:

It is further to be noted that since junctures are introduced for the purpose of reducing the number of physical features that must be recognized as phonemic, we do not require that every morpheme boundary be marked by a juncture or that syntactic structure be determined by distribution of junctures. Only those morpheme boundaries are marked by a juncture where actual simplifications in the transcription are achieved. In other words, junctures are postulated only where phonetic effects can be correlated with a morpheme boundary. (Chomsky, Halle, and Lukoff 1956:68)

The theoretical context of these remarks is an attitude toward phonemics radically different from what had prevailed up to that point in phonological discussion. Chomsky, Halle, and Lukoff (1956) require only that it be possible to translate the phonemic representation uniquely into a phonetic interpretation, not that the relation be biunique. Thus, the junctures need not be discoverable from the phonetic data alone, and (non-phonetic) "morphological and syntactic considerations may be relevant to the preparation and evaluation of a phonemic transcription" (1956: 67).
analyst sets up the transcription on whatever basis (not even excluding, in principle, divine inspiration) seems suitable, subject only to the requirements that mechanical rules can be given for its phonetic interpretation, and that the junctures that do appear only occur at morpheme boundaries. It is noteworthy that essentially all subsequent work has required that junctures be placed on a more principled basis than this.

The actual inventory of junctural elements assumed by Chomsky, Halle, and Lukoff (1956: 69) includes "-" ('internal juncture') which "by and large ... corresponds to the process of word formation" and "=" ('external juncture') which corresponds more or less "to the process of phrase formation." Since they are not discussing phenomena whose scope is smaller than one part of a compound, they do not deal with word-internal morpheme boundaries. Internal and external juncture correspond to the single # in compounds and the boundaries in phrases, respectively.

Actually, the number of distinct junctures is much larger, since each one is annotated with a number that represents its hierarchical relation to the others, or the structural depth of embedding represented by the constituents that meet at the given juncture. Compare the terms of the classic contrast in (5).

\[(5) \quad \text{light housekeeper: } \text{light =}_1 \text{house =}_2 \text{keeper} \]
\[(5) \quad \text{lighthouse keeper: } \text{light =}_2 \text{house =}_1 \text{keeper} \]

The rules that refer to juncture do so in terms of domains that contain internal junctures, weakening or strengthening the stress on one side or the other of the internal juncture depending on its type and relative depth of embedding. In essence, the role of the junctural elements is to support a stress cycle.

The important notions of this theory include the following points:

- Boundaries have no direct phonetic interpretation in themselves;
- Boundaries are necessarily (though not sufficiently) related to abstract, non-phonetic grammatical structure; and
- Boundaries can be referred to by rules that see them as elements embedded in the phonological string.

The next logical stage in the development of the notion of juncture elements (or boundaries) is represented by Chomsky and Halle (1968). The analysis of English phonology in this work is still fundamentally an account of stress, but since it now includes word stress (which Chomsky, Halle, and Lukoff [1956] simply marked by means of the diacritic [+Accent]), it is much more involved with the segmental phonology as well. The apparatus concerning
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boundaries is accordingly more elaborate. We make no attempt to motivate the posited devices here, but simply summarize them. Every morpheme is listed as a lexical item, and presumed to be delimited by occurrences of the boundary "+.". Morpheme-structure rules (or conditions) have as their scope a string of material bounded by +s and containing no internal instances of "+." The element "+", thus serves as the delimiter of the domain of distributional restrictions, as in Pike's theory. The syntax supplies a fully labeled bracketing of the string of morphemes (a Phrase Marker) to the phonology. 'Re-adjustment rules' may alter this bracketing (basically, establishing phonological phrasing). The element # ('word boundary') is introduced into a phrase marker – again, as with "+", serving as the delimiter of a domain – on each side of every constituent that dominates a lexical category (considered here to include Noun, Verb and Adjective). Sequences of boundaries that arise from these principles can be reduced. A "++" adjacent to a "##" disappears: that is, adjacent boundaries of different types are counted as constituting a single instance of the strongest boundary among them. A sequence of several instances of "##" can be reduced to a single 'terminus' ##, provided it comes at the edge of the structure or contains a bracket sequence "\[.\]"). These terminus elements thus provide a partitioning of the string into phonological words. Other sequences of ## are replaced by a single (non-'terminus') #. Finally, and in addition to "++" and "##", there is a third boundary element "==" which occurs inside certain lexical items (to separate prefix from stem).

Re-adjustment rules (and conceivably even phonological rules) can affect boundaries: instances of # can be 'lowered' to + by rule, for instance. The resulting structure has four sorts of boundary element: (a) +, which separates morphemes within a word; (b) ==, which separates certain English prefixes from a following stem; (c) #, which separates morphemes in certain higher-level constructions (in particular, some affixes – including all productive inflection – are delimited by # rather than +); and (d) ## or 'real word' boundary, which occur at terminus positions. In addition, the bracketing structure of the syntactic Phrase Marker is still present. The boundaries are thus derived from, but not simply the representation of, this grammatical structure.

A set of cyclic rules then apply within increasingly inclusive domains on the basis of hierarchical grammatical structure, going from the minimal level (morphemes) up to the entire phrase. Many of these rules only apply within a word, and are not to re-apply at higher phrasal levels; to achieve this effect,

* Indeed, much of the discussion of this boundary apparatus in Chomsky and Halle 1968 is similarly unmotivated. Like many other proposals in that work, much of this discussion has the flavor of proposals made for the sake of concreteness, rather than because they could be demonstrated to be correct in opposition to some alternatives.
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such rules are stated in such a way that internal occurrences of # within the string (which will not be present until later cycles of material have been incorporated into the domain of application) will block their application. After each cycle, the brackets that define it (but not the boundary elements) are erased. If the domain of a cycle is a 'real word' (i.e., if it is delimited by a terminus at each end) then a special, designated set of word-level rules apply on that cycle (as well as, and perhaps interspersed with) the other cyclic rules. The terminus elements thus delimit the scope of application of one very particular set of rules.

Phonological rules can be formulated so as to require the explicit presence of a boundary element (+, =, or #) at some specific location within the string. Any boundary also 'counts as' an instance of all lower boundaries. A boundary may be specified as occurring either at one end or the other of the environment, or as embedded within it. In this respect, boundaries are just like any phonological units, and not simply the limits of a given domain.

Special attention is given to the matter of how the absence of a boundary element can be enforced in phonological rules. On the one hand, = and # are treated as full fledged quasi-segmental elements. They are just as much part of the string as, for example, /t/ would be, and so unless the Structural Description of a rule contains some term that explicitly analyzes them, their presence inhibits the rule's application. Thus, a rule requires the absence of one of these boundaries simply by failing to provide for its presence. Uniquely in the case of ‘+,’ however, things are different. Every string of segments in the structural Description of a rule is said to be equivalent, by general convention, to a schema consisting of all possible strings differing only in that some have +s between segments where others do not. The string "abc," that is, is treated as equivalent to "((+a)(+))b(+)(+)." As a result, there is no way to require that ‘+’ be absent from a form, since even where it is not specified it is implicitly possible by virtue of this convention. The only exception to this is that morpheme-structure rules (a special class of rules that apply only in the lexicon, and not in the phonology) only apply within a single morpheme at a time.

Finally, at the end of the derivation, all boundaries are erased. Thus, boundaries have no overt phonetic content. Only by their effects shall they be known unto you.

This theory admits just about every device relating to boundaries that has ever been imagined. The only apparent exception is Moulton's notion of junctures that occur at positions where they would be phonologically useful but grammatically unmotivated (e.g. to account for exceptional stress in German loan words). Even this, however, is not effectively precluded, since the notion of when forms can be assigned internal morphological complexity
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is effectively unconstrained. Some of the formal possibilities made available to analyses include:

The boundaries themselves are feature matrixes just like real segments, and can be operated on by rule. The feature [± Segment] distinguishes segments from boundaries.

Both juncture elements and actual grammatical structure are available to the phonology, and circumstances under which one ceases to be available (e.g. when boundaries are erased or altered) have no effect on the accessibility of the other.

Grammatical structure (including not only domain delimitation but also category labels and everything else in the syntactic Phrase Marker) is all visible to the phonology.

The presence of junctures at any point in a string (within it, as well as at either periphery) can be explicitly required by rule.

Some internal junctures, on the other hand, that can be seen when required are invisible to rules when they would otherwise get in the way.

Some junctures delimit the scope of the domains of applicability of designated sets of rules. Thus, "+" delimits the scope of morpheme-structure rules, and ## (or "terminus") delimits the scope of word-level phonological rules.

On the other hand, grammatical structure (not the presence of boundaries) determines the scope of successive domains of applicability of the cyclic rules.

Features unique to items with the property '[— Segment]' distinguish one boundary from another. The range of possible juncture elements that can be kept distinct is limited only by the number of features one cares to establish to separate them.

When a language has several distinct boundary elements, these can occur in any relationship with one another within a phonological form. That is, there is no constraint that only 'lower-level' boundaries occur inside an element delimited by boundaries of a given type.

It is fairly clear that the later development of the theory of boundaries was bound to be devoted to attempts to constrain the power of these devices, and to limit the ways in which non-phonetic structure could be accessible to the phonology.

9.1.3 Boundary elements and types of rules

We assume that at a minimum, boundaries ought not to be treated as so much like segments that they can bear specified values for 'real' phonological
features. Such a condition could probably be derived from a condition of recoverability, since the boundary elements themselves are deleted by convention, which would have the effect that any substantive features they bore would be unrecoverable. Conversely, segments ought not to have values for boundary features.

The latter half of this proposed limitation seems clearly enough to be a matter of logic, but the former has occasionally been questioned. For instance, Lass (1971) argued that word boundaries had the same effect in Old English as a voiceless obstruent, and thus suggested that the rules of the language could be simplified by assigning $\not$ the features $[+\text{Obstruent}, -\text{Voice}]$. The logic of this argument is that then (for example) the final devoicing rule can be simplified from the formulation in (6a) to that in (6b).

\[
\begin{align*}
(6) \quad &a. \ (i) \ [+\text{Obstruent}] \rightarrow [\alpha\text{Voice}] / \alpha\text{Voice} \\
&\quad (ii) \ [+\text{Obstruent}] \rightarrow [-\text{Voice}] / \not
d
\end{align*}
\]

b. $[+\text{Obstruent}] \rightarrow [\alpha\text{Voice}] / \alpha\text{Voice}$

On the same line of reasoning, it could also be argued that $\not$ is a specifically dental obstruent (since nasals are neutralized as [n] word-finally in, for example, Finnish and Greek, etc.). It quickly becomes apparent, however, that these phonological values are language-particular, which greatly reduces the appeal of the claim that boundary elements actually are assigned features with the same phonetic content as those of (non-boundary) segments. For instance, Halle (1971) points out that while phonological evidence may make $\not$ a voiceless obstruent in Old English, it would have to be a vowel in Latvian, since vowels are truncated finally and before another vowel in that language.

Halle proposes instead that we regard every rule as necessarily analyzing all of its environment, by means of 'end variables,' and then treat those rules that appear to put boundaries into natural classes with segments as involving parentheses. On this view, a rule that deletes a vowel finally or before another vowel would be written as in (7).

\[
(7) \quad [+\text{Syllabic}] \rightarrow \theta / X_\alpha([+\text{Syllabic}] Y)
\]

This says that a vowel is deleted at the right edge of a domain; or domain- Internally if it is followed by another vowel.

One can certainly have qualms about the linguistic significance of Halle's 'solution' to the problem of how processes applicable at boundaries are related to processes conditioned by specific phonological segment types. Furthermore, it still does not cause one class of arguments to disappear: those in which it
appears that a boundary effect is a special case of a rule of *assimilation* to some class of segments (including boundary elements as instantiating one possible assimilable phonetic value). The interest it has, however, lies in the fact that it is consistent with what seems a reasonable prohibition against assigning phonetic features to boundaries. Furthermore, it suggests that boundary effects are typically "edge of domain" effects.

This is a claim that has been made by a number of writers, including Pike, Hyman (1978), and others: the phonological substance associated with the presence of boundary elements is argued to result from a generalization of "edge effects" (in particular, utterance-initial and pre-pausal effects) to "virtual edges." On that view, a similarity with some domain-internal effect, like an assimilation, would be coincidental. An argument in favor of this claim would be instances of historical change where an internal effect (e.g. an assimilation rule) undergoes some change that does not generalize to the boundary case which it superficially resembles.

A different line of attack against the claim that boundaries can bear phonetically concrete features would be to show that the evidence for what those features are is internally inconsistent within a given language: for example, that boundaries have to behave like vowels for some rules, but like consonants for others. This would be a *reductio ad absurdum* of the argument that purported to show the boundaries had features in the first place. We merely offer this as a suggested form of argument, without having any concrete instance in mind. In general, however, the phonological literature has been quite near unanimity in rejecting the assignment of (non-boundary) phonological features to junctural elements.

A view of junctural phenomena somewhat different from that of Chomsky and Halle (1968) was argued for by McCawley (1968) and Stanley (1973). McCawley starts from the observation just cited above (with reference to phonetic parallels established by Lehiste) that when rules are conditioned by the presence of a boundary, the consequence is to generalize an edge effect to a "virtual edge." He thus proposes to take the main role of junctures to be the delimitation of domains whose edges can be referred to. On this view, every rule has associated with it a particular 'rank', defined by some occurring boundary. The several boundary elements are arranged according to a strict ordering. A rule of rank *i* thus applies within each (and every) substring of the form delimited by a boundary of rank *i* (or higher, since any boundary also 'counts as' an instance of any lower boundary). Rules of rank *i* do not refer explicitly to a boundary of that rank, but rather to the edge of their domain, which is implicitly of that type.

On the other hand, within a domain defined by boundaries of rank *i* all lower-level boundaries are transparent to a rule of that rank, though such
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Boundaries may be explicitly required to be present. In other words, the behavior of "+" in the SPE theory (see Chomsky and Halle 1968) is generalized to *any* domain-internal boundary. The practical effect of this for a language like English, with few boundaries, is to make \# transparent within word or utterance domains. In languages like Japanese, Finnish, and Navajo, however, McCawley and Stanley argue that the inventory of boundary elements is greater, and thus the consequences of this convention are more significant. This view has the consequence that rules can never require the absence of a boundary at some designated point in a string, though they can require its presence. The best rules can do is limit their domain so that stretches spanning a boundary of the given type cannot be included.

The central claim of the "ranking" approach is that every morphological element, as represented by the character of the boundary between that element and the one(s) adjacent to it, is associated with a particular subset of the phonology: namely, those rules whose rank allows them to consider the element's interaction with its neighbors. Both McCawley and Stanley are fairly explicit about the association of boundary types with lexical elements (particular morphemes).

But since boundaries are induced by particular lexical items, this has the effect of associating specific phonological behavior with specific morphemes. For instance: the English rule that shortens vowels before clusters is a \(-\)-level rule.\(^{10}\) The affix \(-tion\) is attached to its stem by a \(+\)-boundary, while the regular past-tense ending \(-d\) is attached with a \#. As a result, shortening applies to /kon=vên+tion/ to give [kônvenšn], but not in /kon=vên#d/ ([kônvijnd]). The reason is that the rule parsing the former (but not the latter) representation into \(-\)-domains finds the sequence /... veCC.../ to apply to. Thus, \(-tion/ triggers shortening, while \(-d/ does not. In this respect, there is a similarity between this view of boundaries and the claim of Lexical Phonology that individual morphological processes are associated with a particular subset of the phonology (namely, the rules whose phonological 'level' is the same as that of the morphological rule in question).

On the other hand, the rank of a rule is simply an aspect of its Structural Description, and does not *per se* determine its interaction with other rules. In particular, rules of various ranks can be freely intermixed: there is no requirement to do all of the lower-rank phonology before the higher-rank rules apply, with the single exception of the special status of morpheme-structure rules (in effect, the rules of rank "+,", which must apply in the lexicon and before any of the 'real' phonology). In that sense, this boundary theory could be regarded as not incorporating the "Affix Ordering

\(^{10}\) Or \#-level if there are no \(-\)-boundaries, as argued by e.g. Siegel 1980.
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Generalization (discussed below) which is often taken to be essential to the notion of level ordering.

The ranking theory naturally raises the issue of how the possible ‘topology’ of representations is restricted; that is, what sorts of domains can appear inside others, where ‘inside’ is a relation defined from a constituent structure point of view. Stanley’s work was based on the rather elaborate phonology of the Navajo Verb, which seems to require a number of different rule types defined on different ranks. The picture he develops (though without having a theoretical basis for this result) is that starting from the Verb root, increasing boundary rank corresponds to increasingly comprehensive constituents, with elements at the same level separated only by a lowest-rank boundary.

If Stanley’s result were to turn out to be general, it would suggest that the boundary structure of a complex form reflects its morphological composition: the morphological derivation starts with the root, adds some affixes, which then establish a constituent of the next level up; then some more affixes are added, constituting the next larger domain, etc. It was, however, the analysis of English affixes in Siegel (1974) that established this point in the minds of phonologists generally. Siegel argued that the two classes of affix in SPE, differentiated by their behavior with respect to a number of rules and formally as ‘+-affixes’ vs. ‘#-affixes,’ showed a regular distribution in English words. The two classes of affixes differ with respect to rules such as those in (8).

(8)  a. Rules that apply over + but not over # (thus within #-domains):
   (i) word stress (cf. regiment + al vs. regiment#less)
   (ii) shortening before clusters (cf. retain/retentive)
   (iii) regressive voice assimilation (cf. describe/descriptive)
   (iv) degemination (cf. send vs. /send+t/→sent)

   b. Rules that apply over # (thus within ##-domains):
      (i) progressive voicing assimilation (cf. cats)
      (ii) inflectional epenthesis (cf. blended)
      (iii) post-nasal g-deletion (cf. long+er vs. sing#er)

Examples of affixes of the two classes are given in (9).

(9)  a. + -boundary affixes: -al, -(a)t)ion, -er (comparative), -ic(al), -ify, -itude, -ity, -ous, -t (past), -th, -tive, etc.; con-, ex-, in-

   b. #-boundary affixes: -able, -d (past), -er (agent), -ful, -hood, -ing, -less, -ly, -ness, -z (3sg. pres., plural, etc.); non-, over-, un-

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11 See also Rotenberg 1978 and Aronoff 1976 for further elaboration of these points.
12 That is, the two classes of affixes were assumed in Chomsky and Halle 1968 to be separated from adjacent material by boundaries of these two types.
13 As shown by Aronoff (1976), some instances of -able appear as ‘+ -boundary’ affixation and others as ‘#-boundary’. Thus, comparable “roughly equal” is a form of the first type, while comparable “suitable for comparison” is a form of the second type.
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Siegel argues that all of the + -boundary affixes appear 'inside of' any of the # boundary affixes in a given word. Thus, words like combat + iv+ness occur, but not words like *hopes+less + ity. This is called the "Affix Ordering Generalization." More generally, on a theory like McCawley's or Stanley's, if the boundary elements necessary in the phonology of a given language are arranged in a hierarchy $B_0 \ldots B_n$ (where $B_0$ represents the 'weakest' boundary, such as " +" in English), the Affix Ordering Generalization requires all occurrences of $B_i$ to occur inside of occurrences of $B_j$ for $(o <) i < j$.

So far the general observations above about the association of specific phonology with specific morphological material do not appear to have a principled basis; but we can in fact make use of them to derive a view on which we can largely dispense with the actual boundaries in phonological representations. Let us first assume the following principle of cyclic application of the morphological and phonological rules, which will be further explored below: after each morphological rule applies, the resulting form is subjected to the appropriate rules of the phonology. The result of this operation is then available to serve as the basis of further morphological elaboration, which may in turn lead to further phonological adjustment, etc.

Now we have seen that (in English) there are apparently two sets of affixes, and two sets of phonological rules. Adopting a 'ranking' type theory of rules, each rule is associated with a particular type of affix. Instead of interpreting that observation as reflecting a fact about domain-parsing, though, suppose that we simply associate each affix directly with the appropriate set of rules. That is, after the addition of a given affix (or more generally, after the application of a morphological rule, with whatever structural change, belonging to a given subset of the morphology), exactly those phonological rules associated with morphological rules of the corresponding class operate on the resulting form. Now when an affix is added, the result is subject to all (and only) the rules of appropriate class.

On these assumptions, we could now convert Siegel's observation to a principle of organization of the grammar if we could require all of the morphological rules associated with one kind of phonological behaviour (i.e., all morphology triggering phonological rules of the same rank) to operate before any of those triggering the phonological consequences characteristic of morphological rules of the next rank. This yields the picture which has become the standard one in Lexical Phonology, in which the rules and the affixes are each assigned to a level of the lexicon and these levels are strictly ordered with respect to one another: a theory usually associated

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14 Some provision must be made for a low-level boundary separating several affixes at the same level on Stanley's view. The consequences for the 'Affix Ordering Generalization' are not immediately clear.
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with the term Level Ordering.

Level Ordering in this sense can easily be seen as one specific (and rather restrictive) way of implementing a theory of ‘boundary ranking’ of phonological rules. On the view proposed by McCawley and Stanley, differences in ‘boundary type’ (and hence, differences among the various boundary elements posited for a given language) can be related to the fact that the morphological structure of words is developed in a series of progressive layers (some of which may involve more than one affix). Within this framework, differential phonological consequences ensue from the morphological operations that yield these different layers. This is clearly quite close to the picture in Lexical Phonology, though with some differences: importantly, the Affix Ordering Generalization does not necessarily follow, since there is no a priori reason why affixes associated with different boundary types could not be intermixed in arbitrary sequence.

It is worth emphasizing, therefore, that the incorporation of the Affix Ordering Generalization into a theory of Level Ordering constitutes an empirical hypothesis about the way the rules of a grammar will in fact turn out to be ordered. The more basic apparatus within which such a claim has its content is the following. Rules of the phonology can be divided into subsets, not necessarily disjoint. To each such subset, we can assign a phonological ‘type.’ The rules of the morphology can be similarly divided into (corresponding) subsets, where the type of a morphological rule is determined by the set of phonological rules that are applicable to the result of applying that rule. The claim that grammars obey a principle of ‘Strict’ Level Ordering can be formulated as the requirement that morphological rules of different types are strictly ordered with respect to one another: that is, all rules of one type (or ‘level’) apply first, followed by rules of the next type, etc., with no intermixture. But if the facts warranted it, we could maintain a weaker version on which morphological and phonological rules are still associated with one another in a system of corresponding ‘types’, but where the rules of a given type are not invariantly ordered with respect to those of other types (i.e., where the Affix Ordering Generalization does not hold). If we take the association between subsets of the morphology and particular phonological behavior to be the central content of the notion of “Level Ordering,” then we see that (at least this sense of) Level Ordering and the Affix Ordering Generalization are logically independent principles.

9.1.4 Alternatives to Boundary theory

We can now ask what function is served by positing boundary elements themselves in phonological representations. In his discussion, Stanley identified three different functions that boundaries appeared to serve in the
9.1 Boundary elements

formulation of individual phonological rules: (a) they may delimit the scope of a rule by ranking it; (b) they may be explicitly required within the environment of the rule; and (c) they may be required at the edge of the environment. Of these, the third is really a set of special cases of the first two. On the assumption that boundaries ought not to bear phonetically concrete properties in their own right, their very status as components of strings of phonologically specified segments is quite anomalous; and indeed they pose some formal problems (see also Pyle 1972). It would therefore seem theoretically desirable to reduce reference to them to a minimum or indeed to eliminate entirely this class of pseudo-phonological entities. It is to that problem that we now turn.

Given a theory based either on a boundary-based ranking of rules or on cyclic application and 'Strict' Level Ordering, we could eliminate reference to the boundary itself for the purpose of delimiting the scope within which rules operate. This is obvious by definition for the ranking case; a Level-Ordered theory effectively yields the same conclusion, since on this view rules apply cyclically and thus only have a chance to see the material which has been introduced up to that point. If the Affix Ordering Generalization is correct, this means that level 1 rules ($$\#$$-rank rules) will never have access to more material than occurs within a $$\#$$-domain. Only level 2 (or $$\#\#$$-rank rules) will get to see material containing (the equivalent of) an internal $$. The issue of delimiting the scope of rule applicability could thus arise within a Level-Ordered theory only to the extent that Strict Level Ordering (i.e., compliance with the Affix Ordering Generalization) is relaxed.

Similarly, if we wish to eliminate boundaries as entities in themselves, we could reduce any apparently necessary reference to boundaries at the beginning or end of a domain to a direct reference to domain edges themselves. Though functionally equivalent, the latter is a notion that is logically quite separate from the positing of quasi-segmental boundary elements within a domain (including the special case of elements located at the edges of domains). The question that remains to be addressed is that of the functions served by references to properly domain-internal occurrences of lower-level boundaries, and the extent to which these too can be eliminated. In the present section, we examine the range of cases in which the internal morphological structure of a phonological domain appears to be relevant, and the proposals that have been made for representing such structure without an appeal to pseudo-segments.

When rules are formulated so as to require a boundary properly within (rather than at the edge of) their Structural Description, the effect of that boundary is to prevent them from applying entirely within a lower-level unit (typically, a morpheme). Thus, in Finnish, there is a process of assibilation
The relation of morphology to phonology

by which /t/→[s] before /i/, as in /halut + i/→[halusi] “wanted.” This rule must be prevented from applying when the /ti/ sequence is part of a single morpheme: thus, /neiti/ is simply [neiti] “Miss,” and does not become *[neisi].

When a rule operates in this fashion, one might be tempted to put a boundary somewhere in the environment so as to restrict its application to morphologically complex forms. The first problem with this solution is that the requirement for a facilitating boundary may be satisfied (essentially) anywhere, necessitating a rather complex environment statement. For instance, Kiparsky (1982a: 37) suggests that trisyllabic shortening in English would have to have an environment like that in (10), which obviously misses whatever generalization there is to be found in the conditions for this rule’s application.

(10) _< + >_aC_o <+ >_bV <+ >_cC_o <+ >_dV
    Condition: a or b or c or d

In the Finnish rule of assibilation, one would apparently have to formulate the rule with a “+” preceding the /i/ that triggers the change from /t/ to [s], thus blocking its operation in (monomorphemic) /neiti/. This cannot be correct however: underlying /ykte/ “one”15 becomes yksi after the raising of the final /-e/ (i.e., /e/-→[i] at the right edge of words) followed by assibilation. In this case, there is no reason to believe that any boundary at all intervenes between the assibilating /t/ and the following /i/ that conditions the change.

The right generalization is suggested by Kiparsky (1982a), at least in an approximate form. Such rules are subject not to a requirement that a boundary be present, but rather that they apply if and only if their Structural Description is met within a ‘derived environment.’ This latter condition is met, roughly, where the applicability of a rule on a given cycle16 is crucially due to one of the circumstances in (11).

(11) a. Material added on this cycle has caused the form to satisfy the rule’s environment; or
    b. The previous application of another rule on this cycle has set up the rule’s environment.

We will refer to such a restriction generically as the ‘Derived Environment Condition,’ recognizing that its precise expression and scope of applicability (while obviously of great importance) are not completely clear. A previous formulation, superficially rather different but with much the same effect, was the ‘Alternation Condition’ of early work on the question of phonological abstractness. This was stated in Kiparsky (1973b: 65) as the condition that

15 For justification of this form, see genitive yhden in which the basic /t/ surfaces as [d] through consonant gradation and the continuance of /k/ disimilates to [h].
16 Where each cycle consists of the application of some morphological process together with whatever phonology is associated with it.
"Neutralization processes cannot apply to all occurrences of a morpheme."
Confined in scope to the class of ‘neutralization processes,’ this statement
recognized that not all phonological rules are subject to the restriction: for
example, purely ‘allophonic’ rules (i.e., rules introducing non-contrastive
properties like aspiration in English) are not. Furthermore, ‘structure building
rules’ like syllabification and stress (in some languages) have to be allowed
to apply within non-derived environments, possibly to all occurrences of a
given linguistic element.

The Alternation Condition was supplanted by a proposed condition on
rule application, requiring that “Obligatory neutralization rules only apply
in derived environments” (Kiparsky 1982a: 40). Subsequent efforts have
focused on attempts to delimit the precise set of rules (or rule applications)
subject to this condition. Ceteris paribus, one might expect such a condition
to apply to all (and only) those phonological rules that apply cyclically in
conjunction with morphological operations: the ‘lexical rules’ (in one sense
of ‘lexical’). This suggestion was explored in Mascaro (1976), where it came
to be known as the ‘Strict Cycle Condition.’

Unfortunately, some apparently “lexical” rules have to apply within
underived domains. Kiparsky (1982: 40f.), for instance, claimed that English
velar softening (yielding alternations like critical/criticize) must be applicable
even in non-derived environments. The reason for this is that a class of
exceptions to intervocalic s-voicing can be eliminated if we treat some
consistently voiceless s’s as underlying /k/s (cf. receive vs. consist, resist).
Kiparsky’s suggestion was to treat velar softening in English as a ‘post-lexical’
rule (and thus not subject to the condition under discussion here), but this is
less than satisfactory within the general perspective of Lexical Phonology.
Since velar softening obviously has many lexically idiosyncratic exceptions,
it would appear to be a ‘lexical’ rule in all senses except that of being subject
to the present condition on its application.

Another case of a ‘lexical’ rule that must apply in underived environments
is provided by Faroese. This language has a rule deleting intervocalic /g/, /d/
(cf. Anderson 1974b: 170ff.). This rule only applies at a point after certain
affixes have had a chance to be added: the affixes in question can trigger the
syncope of one of the surrounding vowels, in which case the Consonant
Deletion rule is blocked. This gives rise to alternations such as that in vedur
[vez:ur] “weather,” dative singular vedri [vegr:ri]. The stem here is /vegr:/, and
the underlying form of the dative is /vegr:+i/. The latter undergoes syncope
to give [vegr:ri] without problem. The bare stem, however, serves as the
nominative; this undergoes /g/ deletion, even though the environment of that
rule is satisfied in an underived environment. The rule in question cannot be
post-lexical (in the sense of Lexical Phonology), since it has lexical exceptions
such as synagoga [su:na’go:ga] “synagogue.”
Note that the morpheme-internal applications of this rule in fact conform to the original Alternation Condition, since they produce alternations and thus do not apply to all instances of given unit (e.g. the stem). The morpheme-internal applications of velar softening in English, on the other hand, do not conform to this, since, for example the stem -ceive must apparently undergo velar softening in every occurrence if the failure of s-voicing in words like receive is to be accounted for by deriving it from underlying */kEv/ or the like. Proposed ways of accommodating such examples have included the suggestion that designated strata of the lexical phonology might be 'non-cyclic.' This is rather unappealing, however, since English velar softening (assuming it is a rule) applies at level I of the phonology. This would appear to make the designation of a level as 'non-cyclic' a mere device for indicating the fact that some set of rules is not subject to the Derived Environment Condition.

Similarly, there seem to be some rules that are subject to the Derived Environment Condition even though they cannot be lexical because they apply at a phrasal level (see Kaisse 1986; Iverson 1987). These complications seem to suggest that at the present stage of our knowledge, we cannot establish a precise equivalence between the set of rules that conform to the Derived Environment Condition and those displaying some other independently motivated property. While it is most common for such rules to be cyclic ones operating within the phonology of lexical items, enough exceptions exist in both directions to make it appear necessary to say simply that as part of its formulation, a rule may (idiosyncratically) be [+Derived Environment].

Notice that although it would obviously be desirable to eliminate this parameter in the formulation of individual rules, it still represents an advance over a theory that represents sensitivity to internal structure by encoding overt boundary elements in the Structural Descriptions of rules. For one thing, the notion of a 'derived environment' appears to be more general than just that of 'including internal morphological structure,' since such rules seem generally to be able to apply on the basis of previous phonological modification as well as of internal morphological complexity. For another, the device of boundary elements would allow rules to be sensitive to boundary elements in some positions but not others, while the Derived Environment Condition makes this a unitary property of the relation between a form and a rule: either the rule is applicable by virtue of some (morphological or phonological) change on the current cycle, or it is not. The condition is thus more restrictive in that it allows fewer degrees of freedom to individual rules, while still allowing us to achieve the results internal boundary elements were intended to serve in the formulation of phonological rules.

On the basis of this reasoning, we can probably replace explicit reference
to boundary elements in the interior of a domain with some suitable formulation of the Derived Environment Condition. In chapter 10 below, we will provide some further refinement of this notion and place it within a broader context. In general, we might hope that rules would never need to refer to explicit boundary elements, referring instead to the derivational history of the form. This appears to be possible both in the case of peripheral boundary elements (which can be treated as 'edge effects' within cyclic domains), and of internal ones (whose effects can be founded on a comparison between the input to a given cycle and the present shape of the form to yield 'derived environment' effects). We therefore do not need to recognize a class of pseudo-segmental boundary elements embedded within the phonologically motivated content of a form in order to represent the effects of its morphological composition on phonological rules that apply to it.

9.2 The interaction of morphology and phonology

The next question to be addressed concerning the relation between sound and word structure is the manner in which rules in these two domains interact with one another. In the immediately preceding subsection, we adopted (from the literature on Lexical Phonology) a position that is probably familiar to most readers. On this view, the morphology and the phonology are related in cyclic fashion, with each morphological operation being followed by a pass through an appropriate set of phonological rules (perhaps with some further 'post-lexical' phonological rules operating on fully lexically interpreted structures). This is hardly the only possible position on rule interactions, however, nor even the most obvious default assumption. We attempt to sketch in the present section some of the considerations that have led to its adoption.

The starting point for discussion of this issue might as well be the position of Chomsky and Halle (1968). According to that view, the syntax constructs a (lexically interpreted) Phrase Marker containing all of the relevant morphemes (or formatives), and this serves as the input to the phonology. The architecture of the resulting model is given in Figure 9.1.

On this view, all of the phonology comes 'after' (i.e., presupposes) all of the morphology. But in fact there are a number of cases known in which some aspect of the morphology has to presuppose (i.e., come 'after') some rule of the phonology. An example is the formation of imperatives in Danish (see Anderson 1975 for discussion of this and other such examples).

In Danish we have both long and short vowels and consonants in stems. An important reflex of length is the accentual feature *stod* (glottalization of either the vowel or a post-vocalic sonorant in the affected syllable). Although
surface forms contrast in the presence vs. absence of *sted*, most occurrences of this phonological element can be regarded as rule-governed in terms of a form's underlying shape (together, in some cases, with its morphological composition).

An important rule for *sted* inserts a feature of glottalization on a long vowel or a long post-vocalic sonorant in final stressed syllables. Words which are otherwise similar in form can thus come to differ in whether or not they have a *sted* depending on the presence of an appropriate long segment, as in the pairs of roots in (12).

(12)  
| C vs. CC: | spille [spell] | "to play" | spilde [spil] | "to waste" |
| V vs. V: | bade [bæd] | "to bathe" | mase [maes] | "to toil" |

Now what is interesting for present purposes is the fact that the imperatives of all of the words in (13) have "sted-basis" (i.e. a long vowel or sonorant):
The interaction of morphology and phonology

We can see that all have the requisite long segment in their infinitives, but this is not true for the stems of *spil* "play!" or *bad* "bathe!," as shown by the *stood*-less Noun forms (consisting of the stem alone). This suggests that the imperative should be derived from the infinitive, rather than directly from the stem.

But where does the long vowel (or consonant) come from in the infinitives *spille* and *bade*, if it is not present in the stem? In fact, it has been shown by the Danish linguists Jørgen Rischel and Hans Basbøl (see Anderson 1975 for references) that this length is predictable. In structures of the form */VČa/*, where the first vowel is stressed, *either* the V or the Č is lengthened, depending on the precise identity of the segments involved. The rule is complex, but quite mechanical. However, it applies if and only if the *VČ* sequence is followed by an unstressed */a/ - a condition which is met in the infinitive (whose ending, in most Verbs, is exactly */ + a/) but not in the basic stem.

The rule for forming the imperative in Danish, then, operates on the infinitive, and deletes a final -a if one is present. The derivation we want for an imperative like *bad* "bathe!" is given in (13).

(13) /baed/ → /bæda/ → /bædə/ → /bæ:da/-infinitive/ /ba:da/-imperative/ /ba<da/-stood, etc [bædδ]

But in this derivation, the (phonological) rule of Vowel Lengthening must crucially precede the morphological rule of Imperative Formation, contrary to the picture in figure 9.1.

If we conclude that in some instances, the operation of phonological rules may precede that of certain morphological rules, does this mean that the phonological and the morphological rules are (potentially) just one big lump, and that anything goes as far as their interaction is concerned? Certainly not. The guiding intuition of the ‘traditional’ view was that the morphology (then considered a part of the syntax) serves to create new meaningful combinations of material, which the phonology then ‘adjusts’ to suit the sound system of the language. In contemporary theories, Word Formation Rules operate on words (really stems, as we have noted at various points above, but we ignore the difference here), and do not directly concatenate morphemes into phrases and sentences. This suggests a reformulation of the traditional picture: a Word Formation Rule produces forms that are subject to the phonology, yielding phonologically adjusted stems. These stems, in turn, can serve as the input to further cycles of Word Formation as in (14).

(14) **Word Formation Rules** → **Phonological Rules** → Lexical Items

17 For those Verbs whose infinitives end in another vowel, the imperative is identical with the infinitive: e.g. *gaa* "to go; go!," phonetically [gɔɔ].
This picture now provides a straightforward way to derive the Danish imperative as in (15).

(15)  

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<th>Lexicon:</th>
<th>WFR:</th>
<th>Phonology:</th>
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<tr>
<td>(Cycle 1)</td>
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<td></td>
<td>(stem)</td>
<td>(infinitive)</td>
<td>(length, etc.)</td>
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<td></td>
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<td>/X/→/Xa/</td>
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<tr>
<td>(Cycle 2)</td>
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<td>(stem)</td>
<td>(stød)</td>
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<td></td>
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<td>/X(ø)/→/X/</td>
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<td>/ba:e/</td>
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<td>[ba:eð]</td>
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In this way we can say that (within a given cycle) the phonology operates on the results of the morphology; but since the result is a lexical item, further Word Formation Rules can operate on it, resulting in a global derivation in which some phonology (that of cycle₂) precedes some morphology (that of some cycleᵢ, where j>i).

This approach also resolves some (though not all) of the ‘ordering paradoxes’ noted in work of the late 1960s and early 1970s. Consider the pair of derivations in Icelandic shown in (16). By invoking the cyclic interaction of phonology and morphology, we can account for the fact that u-umlaut precedes syncope in some derivations (e.g. that of jökla “glaciers [gen.]”) but follows it in others (e.g. that of kötlum “kettles [dat.]”) without introducing an ordering paradox.

(16)  

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<th>Lexicon:</th>
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<th>Phonology:</th>
</tr>
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<tbody>
<tr>
<td>(stem)</td>
<td>/jak(+i)/</td>
<td>/jákul/</td>
<td>/X/→/Xul/</td>
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<tr>
<td>(deriv.)</td>
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<td>(syncope)</td>
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<td>(u-umlaut)</td>
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<tr>
<td>(stem)</td>
<td>/jökul/</td>
<td>/jökula/</td>
<td>/X/→/Xa/</td>
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<td>(gen.pl.)</td>
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<td>(syncope)</td>
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<td>Output:</td>
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The model of Lexical Phonology incorporates this architecture: the interaction of Word Formation with phonology displays such a cyclic structure
in derivations. Another central claim of that theory, however, is that there is additional structure to be imposed on the derivation.

As we noted above in section 9.1.3, there are (grossly) two sorts of affix in English, associated with two distinct sorts of phonological behavior. Some affixes (e.g., -ity in profundity) form an integral part of the phonological word with the material they are added to, interacting extensively with this material in determining the stress pattern and segmental shape of the word. Others, however (e.g., -ness, as in profoundness), are more loosely connected with their bases, and the addition of these affixes causes little or no alteration of their stress pattern or shape. The original accounts of this distinction were given in terms of differences between the boundaries separating affixes from the stems to which they attach. Various aspects of the boundary theory were less than satisfactory, but one point in particular attracted attention: by and large, all of the "+" affixes are attached to a word before any of the "#" affixes. Thus, we get [[natur+al]+ize]table but not *[collaps#able]+ize. This observation is what has been called the "Affix Ordering Generalization" above.

But with the assumptions we have made above, we can eliminate the old boundary theory of how to distinguish the two sorts of affix, with all of its problems. We can recognize that there are (at least) two classes of Word Formation Rules, and two sorts of phonological behavior. Instead of having rules be sensitive to the presence of "+" vs. "#," we can class them as 'level I rules' vs. 'level II rules.' We can then say that the "level I" morphology and phonology forms one subsystem of the grammar, and the 'level II' morphology and phonology forms another, where all of 'level I' precedes (and forms the input to) 'level II.'

This provides us with the basic notions of Lexical Phonology then, which are the following. (a) The morphology and the phonology interact in a cyclic fashion, with the output of each Word Formation Rule undergoing the (appropriate) rules of phonology. (b) Affixes can be divided into classes (or levels), where each class of affixes has a particular subset of the phonology associated with it. (c) According to the Affix Ordering Generalization, all of the (phonology and) morphology of level I precedes that of level II, etc. Languages may have different numbers of levels: English is said to have three levels, including what we have treated as levels I and II above and a distinct level at which regular inflectional affixation occurs. This leads to a picture like that in figure 9.2.

This hypothesis about the organization of the lexicon is not unproblematic. Most importantly, the generalization that all 'level I' affixes are attached before any 'level II' affixes (referred to above as the Affix Ordering Generalization) is by no means a secure one. Aronoff and Sridhar 1983, Goldsmith 1990, Fabb 1988 and other references cited in these works provide
a number of substantive arguments that the generalization cannot be maintained. In addition, a number of words seem to demand a morphological structure on this view which is at variance with their semantic structure. For example, in the word *ungrammaticality*, the affix *-ity* can be shown to be at level I by its phonological behavior, and thus attached before the level II prefix *un-*, but the meaning of this item is clearly better represented as *[[un-grammatical]-ity]* than as *[[un-grammatical]-ity]*, as the morphology would seem to demand. The literature on such 'bracketing paradoxes' is by now quite considerable (see Pesetsky 1985), but inconclusive; we return to this point in chapter 10 below.

The principles of level ordering and cyclic morphology–phonology interaction at each level constitute the foundations of the theory of Lexical Phonology and Morphology. Other points within this theory, such as the properties of a class of post-lexical rules that apply after all of the lexical rules, the degree of specification of lexical entries, and other issues that have occupied researchers belong more to the study of phonology than morphology. For reasons of space we therefore confine the presentation of this influential current view to the remarks above, which bear on the relation between morphological processes and the rules of the phonology.
9.3 Conclusion

On the basis of the considerations in the preceding section, we adopt a view of the interaction between morphological and phonological rules that is based on some of the central premises of Lexical Phonology: specifically, the assumptions that (a) morphological and phonological rules interact in a cyclic fashion, with phonological adjustment following each morphological operation; and (b) rules of each sort are divided into subsets, such that a given morphological operation leads to the potential application only of the appropriate subset of the phonology. This is roughly the same as the principle of Level Ordering, except that we do not expect the Affix Ordering Generalization to be satisfied in all cases. There are of course a large number of issues left unsettled and decisions left unjustified in this position, but since the subject matter of the present work is primarily the organization of morphological systems, we leave these in their present state.

The second concern of this chapter, to which the bulk of it was devoted, has been the manner in which phonological rules might refer to information about the morphological structure of complex forms. We concluded that there is in fact no warrant for the assumption that morphological structure is encoded in the form of Pseudo-phonological ‘boundary’ elements in the phonological representation. On the cyclic, rule-based view taken here, the work previously done by such boundary elements can be accomplished by allowing rules to refer to the edges of the domains within which they apply, together with a limitation of the applicability of many (though not all) rules to ‘derived environments.’ As a result, the ability of phonological rules to refer to morphological information per se is greatly reduced or even eliminated. In the following chapter, we will generalize this conclusion with respect to other aspects of grammatical structure.
10 How much structure do words have?

The concern to be addressed in this chapter is a rather fundamental one: what do we find when we examine the internal form of a word? That is, when we consider the form of a word, what kinds of structure ought it to be taken to have, as a matter of its form? There is a tendency in doing linguistic analysis to assume that any information we can supply about linguistic elements constitutes a kind of "structure" that they have, but this clearly conflates several distinct notions. For instance, in discussing the word *rear* (as in *When Trigger reared suddenly, Roy Rogers fell off*), we can note that its source is Middle English *reren*, Old English *rēran*; and that its relation to modern English *rise* constitutes one of the few remaining pairs of English words illustrating Verner's Law. Surely, however, we would not want to say that this information is part of the structure of the word *rear* in the way that, for example, the organization of its phonological content into segments and syllables surely is. Information about the etymology of a word is properly given in the form of a description of its history and derivation from earlier forms; information about segmental and syllabic structure, on the other hand, is simply one aspect of the form or internal organization of the word itself. The principal goal of this chapter will be to argue that in this respect, information about morphological structure is more like etymology than phonology. In particular, there is no persuasive reason to assume that (most) words 'have' an internal morphological structure in the way they 'have' phonological structure. There are actually some reasons not to assign this additional structure in the representation of words.

10.1 Eliminating word-internal structure

Consider a representative English word – say, the word *cat*. This word clearly has an aspect represented by an analysis of its sound: perhaps [kʰæt] (with appropriate autosegmental and metrical structure). Another aspect of the word's structure is an account of its meaning: perhaps "A carnivorous mammal (*Felis catus*) long domesticated and kept by man as a pet or for
catching rats and mice.” Furthermore, we have not given a full account of what a word is until we have described its syntax: in this case, by saying that *cat* bears the categorial property [+Noun] (or perhaps some other combination of specifications that amounts to the same thing). All of these aspects of words have been discussed in previous chapters: since a word is an association between sound and meaning that fills some syntactic function, this much is irreducible. The question is whether any of the other things we can say about words ought to be treated as a matter of their internal structure.

There is one prime candidate for such additional structure. Since early in the structuralist period, it has been assumed that (independent of their phonological organization) words are also divisible into **morphemes**. A theory gradually grew up over time according to which the phonological forms of these elements are separated from one another by quasi-phonological ‘boundaries,’ and organized into a hierarchical structure like a Phrase Marker:

(1)

![Diagram of a Phrase Marker structure](image)

"discontentedness"

The precise details of such representations differ from writer to writer, according to whether discontinuous constituents are allowed, just what labels (if any) can be assigned to the constituents, etc. What is essential is that the kind of theory we refer to treats words as having – as part of their internal structure – a decomposition into morphemes, where the morphemes are organized into larger constituents, and eventually into the entire word. Variations on this scenario are represented, for instance, by such views as those of Selkirk (1982) and Di Sciullo and Williams (1987), who treat morphology as the ‘internal syntax’ of words.

1 Since I have no serious theory of what the semantic representation of a word ought to look like, I will allow this citation from Webster to stand in place of one. While ordinary-language paraphrases are surely not a very good formalism for semantic form, they are probably as good as things like [CAT].
As an example of a theory which takes a position on the presence of motivated structure for words we consider briefly the view of Selkirk 1982. At the beginning of this book there are some disclaimers about the comprehensiveness of the account it offers: these in general point toward the work of McCarthy and the special problems posed by Semitic 'non-concatenative' morphology. Confining our attention therefore to the adequacy of this view as a theory of, for example, English, we note that it assumes that an account of word-internal constituent structure is the central part of a morphological description.

To begin, let us confine the discussion to Selkirk's account of affixation. An initial argument for assigning constituent structure to words is the claim that native speakers have intuitions about the structure of words. It is by no means clear how this 'fact' is supposed to have been established, however. Surely native speakers have opinions about the fact that some words are related to each other, and possibly even opinions down to the level of the observation that some sets of words are related in the same way — for example, adventure and adventurous are related to each other, and perhaps monster and monstrous are related to each other in the same way. Does this imply that the same speakers have an opinion about constituent structure, however? If speakers also have an opinion that sing and song are related, how does this translate into a claim about constituent structure? Since the claim that knowing a language includes knowing its Word Formation Rules also reconstructs these intuitions about word relatedness, there is no particular warrant for reading them as an endorsement of word-internal morphological constituent structure, as Selkirk does.

Constituent structure is also said to be required in order to define the groupings of material that constitute domains for the phonology. This work antedates the rise of Lexical Phonology (see chapter 9 above), and so its conception of the organization of the grammar is somewhat different from that assumed here, as follows. First the morphology is assumed to perform the function of putting all of the morphemes composing a given word together. The phonological rules then apply to the result (as in Chomsky and Halle 1968). All of the morphology is thus in place before any phonological rule applies. On such a view, it is necessary to provide some way of defining the 'inner' domains within which, say, word stress applies; and this is a job which constituent structure could do. If the morphology and the phonology are related cyclically, however, as discussed in chapter 9, the required domains are provided directly as the scope of successive cycles, and so this motivation for assigning constituent structure to words disappears.

The Affix Ordering Generalization (the claim that all 'level I morphology' precedes all 'level II morphology') is reconstructed in Selkirk's system as the
difference between two constituent types: roots and words. Some affixes (those qualified as 'level I' in a Lexical Phonological account) attach to roots and form new roots, while others (those of 'level II') attach to words and form new words. There is also a rule that says, in effect, that a word may consist of exactly a root (in order to get from one type to the other), but nothing that would allow roots to be made up of (or to contain) words. The difference between root affixes and word affixes is thus a reconstruction, in terms of constituent structure, of the level I vs. level II distinction in Lexical Phonology. Selkirk adopts a 'ranking theory' account of the phonological differences between root-level and word-level constructions. Again, however, while assigning different constituent types to morphology of different types would be a possible way of differentiating the phonology associated with them, it is not the only way, and on the assumptions of virtually any variant of Lexical Phonology, this motivation for assigning internal structure to words disappears.

The constituent structure of words is also supposed to be motivated by the fact that a very simple Context-Free Phrase Structure Grammar can generate all of the well-formed word structures. We will discuss further below the extent to which the structure of a phrase-structure description of the internal constituency of words actually provides motivation for such an account. Selkirk claims, however, that there are some generalizations about linguistic structure that can only be represented as statements about the rules in this grammar, such as (1982: 69) "that all regular inflection in English is borne by suffixes" (word suffixes, to be exact). This is in fact rather a weak claim to make, since even English has non-suffixal marking of inflectional categories, and its derivational system allows for both prefixes and suffixes (the only possible morphological operations that exist for Selkirk). Aside from all of the usual problems about morphology that is not well-behaved (infixes, Ablaut, metathesis, etc.), if this is the strongest generalization that it allows us to make about the system of particular languages, this theory does not get very much out of its apparatus. Until we know a lot more about the status of generalizations like "Turkish is exclusively suffixing," we can hardly be sure that the only way to express them is via phrase-structure rules (as opposed, for example, to a language particular constraint on Word Formation Rules). We will discuss these matters of language typology further in chapter 12 below.

On Selkirk's view, the constituent structure is also supposed to be available (at least in principle) to be consulted in applying rules of the morphology. Actual access of this sort, however, is severely restricted as a consequence of the fact that the distribution of particular affixes is controlled by subcategorization statements, and these are prevented in principle from referring to anything other than the properties of the affix's immediate sister. That means
that no information from the constituent structure is available except the properties of the entire (possibly derived) base to which a morphological process applies. Clearly, then, the structure itself can be replaced by a specification of the domain and the range of the function that a Word Formation Rule constitutes.

The bottom line is that in the domain of affixation, the apparent evidence that Selkirk's view offers as justification for constituent structure in words largely evaporates on an account like that of Lexical Phonology. This is not, perhaps, terribly surprising: after all, it was basically these points that motivated the development of Lexical Phonological accounts in the first place. It may seem unfair to take as a point of comparison a theory (like that presented in Selkirk 1982) that was developed before much of the theoretical apparatus now assumed had become available. The reasonableness of this rhetorical procedure is the following: in fact, most linguists have continued to assume that internal constituent structure of the sort argued for by Selkirk should be assigned, long after the persuasiveness of the arguments that might once have been offered for it has evaporated. This sort of persistence of a theoretical assumption well after the loss of its underlying motivation is hardly unique to this case, but it is the sort of situation that theoreticians should be alert for. In this instance, it is useful to examine our assumptions, and to see that the original reasons to believe in the assignment of word-internal constituent structure (independent of the derivations that supposedly give rise to it) no longer have force.

No one would contest the claim that the information presented in (1) corresponds to something that is 'true' of the word discontentedness, but it does not follow from this that the decomposition of the word is an aspect of its structure, any more than its etymology is. To see that there is an issue here, we can contrast such views, based on morphemes, with a picture of morphology as based on a system of rules that map words (or stems) onto other words. Let us call this the 'A-Morphous' view of morphology (an obvious reference to the picture presented in the present book). On this picture, the structure of discontentedness is given by a derivation:

(2) \[ [N \text{ content}] \xrightarrow{\text{dis}} [N \text{ discontent}] \xrightarrow{\text{adj}} [A \text{ discontented}] \xrightarrow{\text{ness}} [N \text{ discontentedness}] \]

Each step of such a derivation maps the phonology, the semantics, and the syntax of its inputs onto the (corresponding) properties of its outputs. It expresses the same facts as the Phrase Marker in (1), such as the observation that some of the subparts of the word are themselves words, the relative scope of morphological operations, etc., but without imposing a distinct structure on derived words to represent their morphological analysis as an aspect of their form parallel to their phonological, semantic and syntactic form.
10.2 Possible motivations

If a structure such as that in (1) does in fact have to be imposed on words, that would presumably constitute an argument for the reality of the constituents of such structures: morphemes. On the other hand, a theory (such as that of the present book) which dispenses with morphemes as units has as a consequence the claim that such structure will only arise when explicitly stipulated in the structural change of a morphological operation. In the usual case, 'complex' words will have only phonological and semantic structure, together with syntactic properties.  

10.2 Possible motivations for word-internal structure

It might seem that the presence of structure like that in (1) can be motivated as a direct extension of X-structure to domains smaller than the word. This is more illusory than real, however. Zwicky (1990) has recently summarized a dozen or so ways in which word internal structure differs significantly from syntactic X-structure. These include:

1. Alternative possible orderings of constituents are common in syntax, but unknown in morphology.
2. Syntactic constituents often admit optional modifiers, but morphological 'constituents' do not.
3. Syntactic heads often agree in some property with their arguments, or modifiers with their associated head, but there is no parallel between derivational affixes and their associated stems.

In addition to the points made by Zwicky, another important difference between syntactic X-structure and the internal form of words is discussed by Williams (1989), who notes that there is no notion in morphology that

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2 On the other hand, there may well exist circumstances in which words do have a motivated internal constituent structure, as we will have occasion to observe below and in chapter 11. One example of a case in which such structure can be motivated by a combination of morphological and phonological factors is provided by Icelandic 'middle voice' (or -sf) Verbs (see Anderson 1990a). The existence of such examples actually confirms the claim that in the more general case no such structure should be attributed to words: the difference between words in which the organization into constituents is motivated, consistent, and limited to a small subset of their morphological properties is thereby opposed to the more general case in which these motivations are absent.

3 In addition to the differences between the two domains noted here, Williams also claims that there are many similarities between syntactic and morphological structure. These are said to include (a) the fact that both use concatenation; (b) the fact that both involve free and bound forms; and (c) the commonality of certain notions of θ-theory and binding to the two domains. The similarities Williams claims, however, are either so superficial as to be of no value in establishing a putative unity of the two (e.g. the role of concatenation in both), or else more in the nature of analogies than substantive similarities. In order to establish the point that the very existence of X-principles in syntax motivates a similar
corresponds to that of "Maximal Projection" in syntactic structure. As a consequence, a number of other properties of Phrase Markers that are linked to this notion, such as case marking, predication, reference and opacity also lack word-internal analogs. A related point has been made by Norbert Hornstein (personal communication). Hornstein observes that of the two major relations which play a role in syntactic principles, C-Command and Government, it is possible to find analogs of C-Command in morphology but not of Government. Again, the conclusion that follows is that the differences between structure internal to the word and that of phrases are at least as important as the perceived similarities. The proposal that word structure can be represented by 'Phrase Markers' does not really support much of a comparison: a Phrase Marker is a rather general sort of object, and it is not surprising that it can be employed to represent (much) word-internal form. Substantive differences between syntactic and morphological structure, however, suggest that no single, unified set of principles (such as those of $X$-theory) that can be generalized to cover both domains.

The motivation for structures like (1), then, must come from elsewhere in the grammar. In general, any rule that made reference to such structure could serve as the basis of an argument for its linguistic significance. A rule in any part of the grammar, that is, which required reference to a structure internal to a word representing its morphological form would constitute _prima facie_ evidence that such structure must be present. The rule(s) in question might be found in the semantics, in the syntax, elsewhere in the morphology, or in the phonology. We consider each of these possibilities in turn in the sections below.

10.2.1 Semantic motivation
A rule of the _semantics_ might need access to the morphological structure of a word in order to compute its (compositional) meaning. Within theories of word structure that assume an assignment of constituent structure to concatenated morphemes internal to words, this structure provides an essential input to rules of projection which interpret the semantic relations between components of meaning on the basis of structural relations among components of word form. Such a process is not at all the only way to express the basic insight that word form and word meaning are related in a fundamentally compositional way, however. On the A-Morphous view, the meaning of a representation in morphology, it would be necessary to show that the same substantive principles are operative in both areas of grammar. Williams does not undertake that task (since the focus of his article is on a substantive _difference_ and not on similarities), and we do not think that close examination would reveal the kind of detailed resemblance that would be necessary.
word is computed by the semantic functions associated with rules of derivation, and these describe the same relations of internal semantic scope, etc., as the ones computed by semantic projection rules operating over representations like (1). Semantic compositionality, therefore, does not provide a motivation for assuming internal morphological structure, since the burden this structure is supposed to support can be assumed equally well by the course of a word's derivational relations to other words.

The only other sort of semantic motivation for access to internal structure would be if this structure itself had to be manipulated directly in some way in order to derive the correct interpretation of a word. Such a possibility was in fact suggested by Pesetsky (1985), who invoked movement in the mapping from morphological to logical form to account for 'bracketing paradoxes' (e.g. ungrammaticality, unhappier, etc.). When Pesetsky's proposal appeared, it provoked a widespread discussion of examples in which the formal composition of words, for one (generally phonological) reason or another, does not seem to match their semantic composition. What is involved is the claim that in some instances, we actually have to build up a reasonably complex structure in order to reorganize it. If words like untruth should be analyzed as the result of applying a nominalization rule to the Adjective untrue (as suggested by their meaning), this is in conflict with their phonology (if we assume the truth of the Affix Ordering Generalization), since -th is a level I affix while un- is a level II affix. Pesetsky's solution to this problem was to build up the form in a way consistent with the phonology of the affixes involved (i.e., as [un[tru-th]]), and then invoke 'Move-α' to "raise" the affix /-th/ so as to include [un[true]] in its scope at the point where semantic interpretation occurs.

In fact, it has been pointed out by a number of writers (see, for example, Mercier 1988) that the movement analysis of these problematic cases actually raises more problems than it solves. Fortunately, there are a number of alternatives to Pesetsky's restructuring account that could be pursued. Among these are the following:

1. Construct the form in the way the phonology indicates (i.e., by first adding -th at level I and then un- at level II), and then manipulate the resulting semantic representation in order to derive the correct meaning.
2. As above, but rebracket the form (leaving things otherwise in place), giving [[un[true]th]] from [un[[true]th]] (as advocated by Kiparsky 1982b). This rebracketed form then serves as the basis of semantic interpretation.
3. Construct the form the way the semantics seems to indicate, allowing
How much structure do words have?

a level I affix to be attached after a level II affix, thus violating (or relaxing) the Affix Ordering Generalization as a condition on level ordering.

4. Construct the form the way the semantics seems to indicate, then rebracket before applying the phonological rules cyclically. On this view, the Affix Ordering Generalization is violated in the morphology (a level I affix is introduced before a level II affix); but it might be preserved in the phonology (the rebracketing could have the consequence of putting the phonology of the ‘outer’ level I affix before that of the ‘inner’ level II affix).

Of these possibilities, alternatives 2 and 4 (as well as Pesetsky’s original movement account) require that brackets be present, because otherwise they cannot very well be reorganized. On the other hand, even these alternatives do not seem to require that the phonology have access to a bracketed representation. The worst that one might be forced to (suggested also by Kaisse and Shaw 1985) is that some of the derivational history of a form might be relevant to its subsequent morphology, though not its phonology. But how much?

Note that the solution in 2 above typically requires more structure to persist than just that present on a given level, contrary to the view of bracket erasure in Kiparsky 1982a, 1982b. The way to get around this is to assume that words which display bracketing paradoxes are somehow marked ‘[--Bracket Erasure]’ in the lexicon. This allows their bracketing to escape to the next level – not a terribly satisfying result. We must ask whether we have any independent reason to believe that in (exactly) these words, structure built on an earlier level is available to later rules.

Alternatives 1 and 3, in contrast, do not require any access to morphological structure as created by the operation of Word Formation Rules. The most appealing alternative, in fact, appears to be one which requires no restructuring at all. Mercier (1988) shows that if one takes account of the semantic-function type associated with particular Word Formation Rules, it is possible to compose these types in a sequence that may be dictated by the phonology but so as to yield the scope relations required by the semantics directly. To go further into the details of this proposal here would take us too far afield: the point is simply that there exist a number of resolutions of the problem posed by ‘bracketing paradoxes,’ most of which do not require access to morphological structure at any point after the operation of a Word Formation Rule. If any one of these can be sustained (as seems likely), the apparent argument for imposing such structure on derived words disappears.
10.2 Possible motivations

10.2.2 Syntactic motivation

We can then ask whether a rule of the syntax could refer to or alter word-internal morphological structure. This possibility ought to be excluded insofar as the Lexicalist Hypothesis is correct, since the essence of this (at least in the relatively strong variant which has genuine empirical content, which we have assumed in this work) is precisely the claim that the syntax neither manipulates nor has access to the internal form of words. The Lexicalist Hypothesis constitutes a program more than an empirical result; but as shown above in chapter 5, it does seem that the only reasons not to maintain it are precisely the morphology-syntax interactions which comprise what is traditionally called inflectional morphology. And in this domain, we can show that the representations common to morphology and syntax should specify the categories expressed by a word, rather than its internal morphological structure per se. Representations such as those in (1) do not do the right work, since the information they contain is both inadequate and excessive for the purpose of supporting the range of morphology-syntax interactions that occur in language.

Recall (from the discussion in chapter 4 above) that such representations are too weak to serve as the interface between morphology and syntax, because information about categories expressed by a form may not be borne by any of its morphological constituents. This is the case with morphological categories that are formally reflected by operations such as ablaut, subtraction, metathesis, etc.; and especially for categories expressed by ‘zero.’ Of course, a common way to describe such situations is to posit overt 0 elements in the analysis of a form as is done, for example, in Halle 1990. Pretheoretically, at least, such ‘zero’ elements are simply a way of designating a class of cases in which the formal composition of a word does not match its relevant morphosyntactic content. In occasional cases it is possible to develop arguments that ‘zero’ is a specific element of morphological expression, but in general specific motivation is lacking, and 0s are posited simply because a relevant category is not overtly reflected in words. Furthermore, in some cases we can show that a generalization is actually lost by such a treatment. In Georgian, for example, third-person Direct Object NP’s are not formally reflected in the composition of their governing Verb. This Verb must nonetheless be treated as ‘agreeing’ with its Object in order to sanction phonologically empty pronominals in this position. However, the generalization that exactly one morphological prefix position is available in the Verb for markers of agreement (which is responsible for the otherwise unexplained fact that certain markers have no phonological content precisely
when the position in question is already filled by another marker) would be violated if this agreement were to correspond to an overt $\theta$ marker.

Representations like the one in (1) are also too strong to serve as the interface between morphology and syntax, because (as we have seen) they contain information about morphological form which appears to be systematically disregarded by the syntax. For instance, the morphological analysis of a word must specify the linear order of its component parts; it must specify whether a single category is reflected exactly once, twice, or at several places within the form; it must include reference to the presence of purely formal, semantically and syntactically 'empty morphs', etc. While all of this information is obviously essential to an adequate account of the forms of words, it seems reasonable to propose that it should be systematically unavailable to the syntax, since there is no evidence that the syntax ever depends on such matters.

For these reasons, the A-Morphous view of morphology suggests that a Morphosyntactic Representation of the inflectional categories expressed by a form, rather than its formal morphological structure, constitutes the interface between morphology and syntax. Many issues remain to be decided, but it is quite clear that the appropriate representation for the information which is communicated between the principles of syntactic and morphological form must have a very different character from that of a direct representation of the latter, as would be implied by structures like that in (1). But in that case, syntactic rules will not be in a position to provide arguments for the presence of internal morphological structure of this sort within words.

An important line of investigation in the recent syntactic literature (which is reminiscent, in fact, of work in the generative semantics tradition during the 1960s and early 1970s) pursues the possibility that rules of the syntax manipulate word-internal constituents to create word units within the syntax. We have addressed this issue in part in chapter 2 above, though some issues were left unresolved there to which we now turn.

It is pointed out by Di Sciullo and Williams (1987) that Lexicalist positions such as that taken in the present book are equivalent to saying that lexical insertion takes place at S-structure, a point that is confirmed by the discussion above in chapter 4. They also suggest that strong versions of Lexicalism are equivalent to (or at least follow from) the notion of bracket erasure: the elimination of morphologically induced structure at the end of each cycle. This seems less clear: even if brackets are erased immediately, there seems nothing inherent in this that would prevent a syntactic rule from having a morphological effect (inserting a causative affix, for example) on the way from D-structure to S-structure. But regardless of what other things go along with it, we can agree that the proper content of the 'Lexicalist Hypothesis' is the
principle of the independence of syntactic and morphological representations, formulated here as (4) in chapter 4.

The principal argument in the literature that this independence (called by Di Sciullo and Williams the thesis of the 'atomicity' of words) is not correct is due to Baker (1985b). The basic point Baker makes is that in morphologically complex forms, affix order is not randomly related to the sequence of operations needed to get from the syntax of the base form to that of the surface form. Rather, the order of affixes 'mirrors' that of the operations. Thus, forms like (3a) will have an interpretation like "they caused each other to (Verb)," while forms like (3b) will be interpreted as "he caused them to (Verb) each other."

(3)  a. Verb + Aff_{caus} + Aff_{recip}
     b. Verb + Aff_{recip} + Aff_{caus}

Baker concludes from this fact that an explanatory theory of morphosyntax ought to recognize a class of unitary operations having simultaneous syntactic and morphological effects. It is the possibility of applying, say, the Causative operation and the Reciprocal operation in different orders that gives rise to the two possible orders of affix with their concomitant interpretations (and not, say, the reverse interpretations). The question, of course, is what sort of operations these are. If they apply 'in the syntax' (i.e. to syntactic structures), they clearly violate the claim that the syntax does not manipulate the internal form of words. If they apply 'in the lexicon' (i.e. to words individually), on the other hand, there is no problem: the operations in question are just derivational Word Formation Rules. Since each Word Formation Rule operates exactly on the cumulative result (phonological and syntactic) of any previous Word Formation Rules, the 'mirror principle' follows.

Baker asserts that there are two arguments for the syntactic, as opposed to lexical, status of the operations subject to the Mirror Principle. One of these is from incorporation constructions. In other work, Baker (1985a, 1987) develops a much more general notion of incorporation than we can consider here, though the discussion to follow seems applicable to Baker's broader proposals as well. The points made below concern the analysis in Baker 1985b, where only Noun incorporation is referred to. The facts cited are those from Iroquoian (specifically, Mohawk) that have been made familiar by Mithun (1984).

The notable characteristic of 'incorporation' constructions is that they appear to involve the formation of a word consisting (usually) of the Verb and the nominal head of one of that Verb's arguments. This material seems clearly to constitute a word, but it seems to be constructed on the basis of the structure of a sentence – hence, within the syntax. The process involved
is argued to be actual movement of the head Noun out of its Noun Phrase and adjunction of it to the Verb. This construction has also been used to argue for word formation within the syntax, on the basis primarily of facts from Greenlandic, in a number of works by Sadock (1980, 1985). On the other hand, a purely lexical analysis was advocated by Sapir (1911). On that view incorporation is a kind of compounding, by which a structure like \([v [n \text{ meat}] [v \text{ eat}]]\) is formed directly in the lexicon, and not by adjunction in the syntax.

Di Sciullo and Williams (1987: 63ff.) effectively refute the arguments offered by Baker for the syntactic nature of Noun incorporation. The first of these is the claim that incorporation can leave behind the non-head portions of the NP, as in the Mohawk example (4):

(4) ka-nuhs-raku thiku
    \(3N\text{-house-white this}\)
    "This house is white"

To this point, they reply that the apparently headless Noun Phrases thus created are just Noun Phrases with phonologically null heads, a structural type which occurs in the language (with an interpretation like "the white one") quite independently of the incorporation construction.

In incorporation structures, it is sometimes possible to leave a copy of the 'incorporated' Noun behind. Though Baker feels that this argues for a syntactic movement account of incorporation, the evidence is effectively turned against his analysis by Di Sciullo and Williams, who note that the apparent 'copy' may in fact be a different word altogether:

(5) ... sha'iteiku niku:ti rabahbot wahu-tsy-ahninu ...
    eight of them bullhead he-fish-bought
    "(He) bought eight bullheads"

Baker's two remaining arguments for the syntactic nature of incorporation are (a) the claim that the position of the argument to be incorporated is generally specifiable in syntactic terms, and (b) the fact that incorporated arguments can introduce new discourse referents. The first of these points is shown by Di Sciullo and Williams to be inconclusively established at best, and in any event is of only marginal relevance to the basic issue. The second point would only constitute an argument if we had an explicit theory of how such referents arise in the semantic structure of discourse (such as the 'Discourse Representation Structure' theory of Kamp [1981] or the 'File Change' semantics of Heim [1982]). In any case, it is possible to show that in the relevant languages discussed by Baker, discourse referents can be introduced when implied by the semantics of a Verb, regardless of whether they are represented by overt independent Noun Phrases. This completes the
demonstration that incorporation constructions have not been shown by Baker to be formed syntactically. If incorporation is not syntactic, however, how does it work? Di Sciullo and Williams suggest that what is involved is typically a lexical process described by a Word Structure Rule (i.e. as a type of compounding). In some languages, though, there is a limited (though perhaps large) number of 'incorporating Verbs' that only occur with their objects "incorporated." In these cases, it is probably appropriate to treat the construction as simply the addition (by Word Formation Rule) of a suffix to Nouns, deriving Verbs. This is apparently the case in K'ak'ala, for instance, where for example the suffix -g can be added to Nouns (with concomitant reduplication) to yield Verbs meaning "to eat (Noun)." This process is presumably the domain of a Word Formation Rule comparable to other derivational types in the language.

The Word Structure Rule (or Word Formation Rule, in the case of languages like K'ak'ala) that is involved in forming 'incorporation' constructions associates a Noun with a Verb (or a Verb-forming suffix) that has an argument structure. In some cases, it appears that the relevant argument position is simply absorbed. In general, though, what happens is that the lexical semantic content of the 'incorporated' Noun is interpreted as specifying the relevant argument position. Thus, incorporating the stem "meat" with the transitive Verb "eat" yields a new transitive Verb meaning "to eat (something that is meat)." Of course, if the resulting meaning is specific enough, it may then suffice to have a zero pronominal ('little pro') in the corresponding argument position. Conveniently, the languages we are interested in always allow for zero pronominals even in non-Subject positions. On the other hand, the position may be further specified by a phrase constructed in the syntax, as in example (5). In this case, the semantic material supplied by the composed reading of the relevant argument position must be combined (or in computational term, 'unified') with the lexically specified semantic material. Since bullheads are in fact a kind of fish, the unification succeeds in the case of (5). Had the Noun Phrase in Object position referred to something whose properties were inconsistent with those of a fish ("three sacks of flour," for instance), the unification would fail, and the resulting sentence would be characterized as anomalous.

The vast majority of Noun-incorporation constructions, then, can be analyzed as purely lexical formations, and there is good reason to do so in some cases. A comprehensive demonstration of this would require discussion of a broader range of examples (and especially of the important arguments from Eskimo adduced by Sadock [1980, 1985]). Nonetheless, there is reason to believe that such a demonstration can in fact be given, and thus the facts
of ‘incorporation’ constructions cannot be cited as clear evidence in favor of word creation within the syntax.

Baker’s other argument for the syntactic status of Word Formation operations is derived from facts concerning reflexives. He notes that in a number of languages (his example being ChiMwi:ni), there is some generalization about reflexive pronouns (n.b., not reflexive affixes on the Verb, which would pose no problem) that depends on grammatical relations. But in causative constructions, exactly those Noun Phrases that bear a given grammatical relation to a basic Verb may also function in the causative as if they bore that same grammatical relation for the purposes of reflexivization, even though they bear a quite distinct grammatical relation to the derived causative Verb.

We treat this construction and its problems here on the basis of Georgian, but the general conclusion is potentially of rather wider applicability. The relevant facts and analyses are discussed in greater detail in Anderson 1989a, from which the discussion below is excerpted.

In Georgian the reflexive pronoun is (tavisi) tavi “him/her/itsel¢ (literally ‘(self’s) head’).” The antecedent of this element must be a Subject: Object or Oblique antecedents (as with English / talked to John about himself, etc.) are not possible. The only circumstance in which a non-Subject can serve as the antecedent of a reflexive is if the Verb is causative. In that case, the Direct Object (but no other non-Subject) can be the antecedent: in sentence (6) below, the reflexive tavisi tav(ze) can refer either to the doctor or to Vano.

(6) ekimma vano alapara maka tavisi tavze
doctor-ERG Vano-NOM he-caused-him-talk self’s self-on
“The doctor, got Vano, to talk about himself,”

It seems reasonable to imagine that reflexivization is a syntactic process (or principle). If, therefore, it has to apply before some other morphosyntactic operation (like the formation of causatives), it would seem to follow that the latter is also in the syntax. In example (6) above, that is, we apparently have to assume that the uncausativized structure underlying “Vano, talked about himself,” is present in the syntax, undergoes reflexivization, and only then does causative formation apply to yield the reading of the sentence on which tavisi tav(ze) refers to Vano. The other reading, of course, on which tavisi tav(ze) refers to the doctor, results from applying reflexive after causative formation.

For some languages, the conclusion that causative constructions must be formed in the syntax is not particularly uncongenial: in French, for example, the causative clearly involves two distinct Verbs (faire “do, make, cause” together with the base Verb). In Georgian, however, such an account is not
possible on the assumptions being made here, because causatives are clearly constructed as a matter of word formation, not syntax. Georgian causatives are unitary Verbs, related to an underlying non-causative by a combination of affixation and word-internal substitution (affecting the pre-radical vowel, which becomes /a-/ and the present/future stem formant: see chapter 6 for these terms). If the syntactic account on which reflexivization can precede (as well as follow) the formation of causatives in the syntax is correct, this would constitute a clear instance of syntactic access to and formation of word-internal structure.

A way to resolve this problem, apparently, would be to claim that both the binding of reflexives and causative formation take place in the lexicon (where they would again be free to interact in various ways). And indeed, lexical analyses of reflexives have been proposed by a number of writers. Grimshaw (1982), for example, provides a particularly detailed argument (within the framework of Lexical Functional Grammar) for the conclusion that the reflexive clitic se in French (and its cognates in other Romance languages) is actually the marker of a lexical process of reflexivization, creating reflexive verbs out of transitive ones.⁴

A central argument for Grimshaw's lexical analysis of reflexives in French, however, is the demonstration that Verbs with associated reflexive clitics are syntactically intransitive. Since the argument structure of reflexive Verbs is thus quite different from that of the associated non-reflexive base, the conclusion that the relationship between them is a lexical one seems quite plausible. But if we attempt to transfer the same analysis to Georgian, we find immediately that we cannot, since Verbs with reflexive pronoun Objects in this language do not differ in transitivity from their bases. This is shown by a number of facts (discussed in Anderson 1989a): the evidence is overwhelmingly in favor of the claim that no detransitivization or other form of argument absorption accompanies reflexivization in Georgian.

Although the specific form of argument invoked by Grimshaw in favor of a lexical rule of reflexivization is thus not available for Georgian, this fact does not by itself exclude the possibility that a lexical process (of a somewhat different nature than that of French) is at work in this language. And in fact, an analysis of the appropriate sort has been proposed elsewhere in the literature. In discussing the analysis of ChiMwi:ni presented by Baker (1985b, 1987), where the facts are quite similar to those of Georgian, Di Sciullo and

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⁴ Actually, Grimshaw's analysis involves a number of distinct lexical operations which all have the effect of creating Verbs with attached clitic se, some of which do not come from basic transitives. The point, however, is that her proposal involves a lexical process of reflexivization.
How much structure do words have?

Williams (1987: 60) propose that a resolution of this difficulty would lie in a lexical account of reflexivization:

Suppose that the reflexive binding is not syntactic, but lexical ... We might suppose that the reflexive rule is an operation on argument structures that adds no affix but rather adds the feature “refl” to the specification of the accusative argument of verbs and binds the Theme argument to the subject argument. The “refl” feature on the accusative argument means that only the reflexive pronoun can be inserted in the position associated with this argument in syntax. (Di Sciullo and Williams 1987: 60)

Note that, in contrast to Grimshaw’s analysis of Romance reflexive clitics, this proposal involves no change in the argument structure of the Verb, but only (a) the addition of a syntactic requirement that a particular argument of the Verb be filled by a NP bearing the feature ‘Refl’; and (b) a change in the Verb’s semantic interpretation, reflecting the fact that the reflexive argument position is interpreted as bound to the same referent as that provided by the Subject NP. While this account was proposed specifically for ChiMwiini, its extension to Georgian involves no substantial change in its spirit or the mechanisms it invokes.

Let us now see how such a lexical reflexive rule could deal with the apparent problem the Georgian causative poses. First, we can note that since it involves a lexical rule of reflexivization, this rule could obviously interact with other lexical rules (such as the causative rule, which must be lexical in order to respect the Lexicalist Hypothesis) in substantial ways. Second, the interaction of lexical reflexivization with causative formation can in fact yield the possibilities we noted for the antecedent of a reflexive, in the following fashion.

On the one hand, the lexical reflexive rule can apply to, for example, laparakobs “speaks” directly, yielding a (homophonous) Verb meaning “speaks to self,” which requires a reflexive Object. If the causative rule now applies to this Verb, a Verb meaning “makes speak to self” is derived. Ceteris paribus, this Verb ought to preserve the properties of the underlying Verb “speaks (to self),” including the restriction that the Direct Object must bear the feature “Refl” as well as the binding of this argument to (what is now) the Indirect Object of the derived Verb. This derivation thus gives one reading of sentences like (6), that on which the antecedent of the reflexive is the surface Indirect Object.

Notice that subcategorization of an argument position for a ‘Refl’ NP must be interpreted as not only a sufficient condition for the appearance of such a NP, but a necessary one as well. This sort of complementarity is often characteristic of subcategorization relations, but remains to be made precise as part of a comprehensive elaboration of the present analysis.
On the other hand, if causative applies to the basic, unreflexivized Verb "speaks" to yield a new Verb "makes speak," there is no reason why this new Verb cannot itself undergo lexical reflexivization. The result would be a Verb meaning "makes speak to self," again requiring a Direct Object NP with the feature 'Refl,' but this time binding that NP to the surface Subject of the causative Verb. This gives the other reading of sentences like (6), on which the antecedent of the reflexive is the surface Subject of the causative.

An analysis of Georgian along the lines of that proposed (for ChiMwi:ni) by Di Sciullo and Williams, then, allows us to derive all of the facts without entailing the conclusion that a syntactic rule of reflexivization analyzes the internal structure of unitary causative Verbs, or that the internal structure of these words is manipulated within the syntax. If we assume that the 'Subject antecedent' condition is actually a condition on a lexical rule of reflexivization, such a rule can apply without modification either before or after the lexical rule of causative formation. Furthermore, the rules assumed here both seem possible as lexical operations, since they only refer to and/or manipulate information that must in any event be present in lexical entries: in particular, argument structures, syntactic frames (or subcategorization properties), and phonological shape.

Despite these advantages, however, the analysis is somewhat unpalatable at first glance, and Di Sciullo and Williams only propose it (for ChiMwi:ni) with reservations. The problems it presents come not from its empirical coverage, but rather from the extent to which it seems to be something of a trick, invoking mechanisms in a lexical context that belong more properly to a syntactic description. There are at least two problematic aspects of the analysis: the status of a feature like 'Refl,' and the extent to which lexical rules ought to be able to refer to facts about binding relations between anaphors and their antecedents. More specifically, the binding principles deal with the ways in which the reference of an anaphor can be determined. That does not, however, ensure that there will be any syntactic feature (like 'Refl') present in syntactic representations and available for use by other parts of the grammar. In order for the proposed lexical reflexivization mechanism to function, it is necessary to assume a syntactic property of NPs (identified by the feature 'Refl') which is available to meet the subcategorization requirement of the derived reflexivized Verbs. Properties like 'pronominal' and 'anaphor' are typically assumed to be lexical properties of words, rather than syntactic properties of phrases. Only if they are taken to be properties of phrases, however, does it make sense for lexical items to subcategorize for them.

Clearly, the binding of anaphoric elements has to be defined over syntactic representations. This is especially true if relations between moved elements and the positions in which they originate are to be treated as a case of
antecedent-anaphor binding (as represented by treating the traces of movement as anaphors). But if the distribution of reflexives is governed by the application of principles of Binding in the syntax, it seems bizarre to allow lexical rules to specify them directly, or even to allow lexical rules to 'know' whether a given argument position will be filled by a reflexive or by a non-reflexive NP. It also seems redundant.

These apparent difficulties can in fact be disposed of, as is necessary if we are to accept a lexical analysis of reflexivization along the lines discussed above. When we examine that analysis in more detail, furthermore, the facts of Georgian turn out to be more consistent with the theoretical claims of this account than our presystematic intuitions (as just articulated) might lead us to expect.

Even in more familiar languages, like English, there are apparently cases in which we want to state of a Verb that it requires a reflexive pronoun as a complement:

(7) a. Fred behaved himself and let Mary have the last piece of duck.
    b. Fred helped himself to more duck.
    c. Fred prides himself on his roast duck.
    d. Fred availed himself of the opportunity to snarf another piece of duck.

There are certain kinds of manipulation which often eliminate purely semantic anomalies in similar sentences: thus, while *I held Fred's breath is bad, this might be a matter of meaning rather than of syntax, since as a matter of the logic of the situation, only Fred can hold Fred's breath. Such a paraphrase is impossible in examples like (7), however: *Only Fred can behave Fred, *Only Fred can pride Fred on his roast duck, etc. These Verbs seems to require a reflexive pronoun as complement, as a genuinely syntactic (and not merely semantic) restriction.

Whatever may be the case in English, a feature of the appropriate sort does exist in Georgian. Georgian reflexive pronouns are formally composed of an appropriate possessive followed by the Noun tavi “head.” Thus, ĉemi tavi can mean either “my head” or “myself.” NPs of this structure in the first and second person have a third meaning, as well, however. When occurring in the position of Direct Object of a Verb that shows agreement with an Indirect Object, they are (as we saw above in chapter 6) the way Georgian expresses pronominals (me, you, us):

(8) a. vano anzors adarebs givis
    Vano Anzor compares Givi
    “Vano is comparing Anzor to Givi.”

b. *vano (šen) gadarebs givis
    Vano you compares-you Givi
    (“Vano is comparing you to Givi.”)
c. vano šens tavs adarebs givis
   Vano yourself compares Givi
   “Vano is comparing you to Givi.”

This fact suggests that the rule of “Object Camouflage” specifies determinate, syntactic conditions under which NPs of the relevant sort are non-reflexive pronominals. A rule assigning essentially the feature “—Refl” under syntactically specifiable conditions is proposed by Anderson (1984b: 209). But if this is correct, it becomes more reasonable to assume that 'Refl' is a feature of NPs that is present (and manipulated) in the syntax, and for which Verbs could in principle be subcategorized.

While reflexive pronouns of the sort considered so far must, as already stated, be bound by the Subject of their clause, possessive reflexives (i.e. tavis “self’s” in spec(NP) position), behave differently. Like English reflexives, they are subject to a somewhat more relaxed condition: they must simply be bound within their governing category. Non-Subjects can thus serve as the antecedents of possessive reflexives:

(9) nino adzlevs bavšvs tavis dedas
   Nino gives child self’s mother
   Nino is giving the child to her mother.

Some explanation is therefore required for the difference in behavior between possessive reflexives and reflexive pronouns, since it is evident that a single binding condition for the class of lexical anaphors cannot describe both simultaneously.

Suppose we were to treat the basic binding condition for anaphors in Georgian as the same one that appears to be operative in English:

(10) An anaphor must be bound within its governing category.

This condition makes no reference to a Subject/non-Subject distinction, and thus is appropriate for the possessive reflexives. Let us further assume that the condition in (10) is part of the syntactic Binding theory, and thus applies to (some level or levels of) syntactic representation. What, however, of the reflexive pronouns?

We can note first that the positions in which reflexive pronouns appear all

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* The literature on Binding in recent years takes various positions on whether the conditions of the Binding theory apply to underlying structure, surface structure, or perhaps Logical Form. All of these are syntactic representations, as opposed to lexical representations, and the distinction among these views is not relevant here.
satisfy the condition in (10), and so there is no reason to reject their characterization as anaphors subject to that condition in the syntax. The difference between possessive and non-possessive reflexives, however, would follow if possessive reflexives are constrained only by the operation of the binding theory in the syntax, while reflexive pronouns are constrained both by the binding theory and by the additional lexical requirement that they be bound to the Subject argument of their governing Verb. In fact, this move might make it possible in general to remove reference to ‘Subject’ from the Binding theory as it applies in the syntax. Anderson 1986b (among many other references) argues that languages differ as to whether they make reference to a ‘Subject’ condition on the antecedents of reflexives in addition to the basic binding condition for anaphors stated in (10). Such a condition, however, is difficult to state over syntactic representations in a completely general way, since the structural properties of Subjects are typically not uniform across languages. As a condition on lexical rules, however, it is plausible to suggest that something like the notion of “external argument” (see Williams 1981a, for example) captures the appropriate additional condition. Conditions on the structural position occupied by the ‘external argument’ of a predicate must be expressed in the grammars of languages for which this position differs in any event, and so the language particular details of a ‘Subject’ condition on reflexives could be relativized in an independently motivated way.

Assuming that a language may (or may not) have a lexical rule sanctioning reflexive pronouns in argument positions where they can be bound to the external argument of a predicate, then, secures two advantages. First, it allows us to maintain the generality of the binding condition in (10) by separating this from the language-particular ‘Subject only’ condition on the antecedents of some (but perhaps not all) anaphors. Secondly, it holds out the hope that we can confine reference to ‘Subject’ in this way to a lexical rule of reflexive binding, rather than introducing this condition (which may involve some language-particular structural properties) into the syntactic Binding theory. Whether this proposal can be extended to a full range of languages, of course, can only be determined on the basis of considerable further research, but it seems at least to be a promising line of enquiry. Both of the suggested consequences of the lexical analysis of reflexives in Georgian, however, are in line with the general trend in recent syntactic work toward modular theories, in which complex sets of facts are decomposed and treated as resulting from the interaction of several individually simple conditions.

Finally, we consider an argument in favor of allowing lexical rules to have access to the fact that certain objects bear the property ‘Refl.’ This derives from a rule (called by Harris [1981] “Co-referential Version Object Deletion”) which applies to certain Indirect Objects. This rule applies when the Indirect
Object expresses either (a) a benefactive or (b) the possessor of the Direct Object; and when furthermore (c) this Indirect Object is co-referential with the Subject of the clause. The rule has two effects: (a) the Indirect Object argument is entirely deleted from the syntactic (but not the semantic) representation of the sentence; and (b) the 'version vowel' position in the Verb’s morphology is filled by /i/ (even if, for the Verb in question, this position would be empty for non-reflexive Indirect Objects). This rule has applied in the second sentences of each of the following pairs:

(11) a. (i) deda u-kerjaš švils kabaš
   mother sews for child dress
   “The mother is sewing a dress for the child”
   (ii) deda i-kerjaš kabaš
        mother sews self dress
        “The mother is sewing herself a dress”

b. (i) mzi učmends das pexasmlebs
    Mzi cleans her sister shoes
    “Mzia is cleaning her sister’s shoes”
   (ii) mzia ičmends pexasmlebs
        Mzia cleans self shoes
        “Mzia is cleaning her (own) shoes”

c. (i) bavšyma dambanan piri
    child washed me face
    “The child washed my face”
    (ii) (me) dav-i-bane piri
        I washed self face
        “I washed my face”

d. (i) kali movståce
    girl I carried his off
    “I kidnapped his daughter”
   (ii) kali mov-i-ťace
        girl I carried off for self
        “I kidnapped myself a girl”

The rule of “Co-referential Version Object Deletion” must involve the deletion of the Indirect Object argument position from the syntactic representation, and not simply its replacement by a phonologically null pronoun. There are several reasons to believe this, which are detailed in Anderson 1989a and will not be repeated here. We can also note, however, that the replacement of the version vowel by /i/ in association with the loss of an argument position affects a number of Georgian Verbs other than those involving Co-referential Version Object Deletion, such as xedavš “sees (transitive)” vs. ixedeba “looks (in some direction; intransitive)”; hkbens “bites (transitive)” vs. ıkbineba “bites, has the habit of biting (intransitive),” etc.
How much structure do words have?

Other examples are given by Vogt (1971: 117). Thus, there may be a single unified process that absorbs one of the internal arguments of a Verb while marking it with pre-radical /i/, applicable in a number of lexical environments. Minimally, however, the forms just cited suggest an association between pre-radical /i/ and argument loss (as opposed to an interpretation on which /i/ is simply a kind of reflexive marker).

We conclude, then, that the rule of Co-referential Version Object Deletion produces Verbs with one less syntactic argument position than was present in its input. Since it thus alters the syntactic frame in which a Verb appears, however, it would be a violation of the Projection Principle for such a rule to apply in the syntax. This can be avoided, of course, if the rule applies in the lexicon.

The conclusion that Co-referential Version Object Deletion is lexical is strengthened somewhat by the following additional observations. First, the rule appears to refer to the substantive content of the 0-role associated with a particular argument, rather than to the grammatical position it occupies (or to the mere fact that it has a 0-role). It is precisely Indirect Objects which are interpreted as benefactives or possessors (a reasonably natural class) that undergo this rule when co-referential with the Subject (or external argument) of their clause. Now in principle, there is every reason to want to exclude reference to the substantive content of 0-roles (as opposed to the fact that a NP has been assigned some 0-role) from the syntax; and we can do that here if and only if the rule of Co-referential Version Object Deletion applies in the lexicon rather than in the syntax. As we saw in chapter 2, morphological rules applying in the lexicon may well refer to the substantive content of the 0-roles associated with particular arguments.

Finally, this rule must also manipulate the internal form of the Verb, inserting the version vowel /i/. Since Indirect Objects can appear with Verbs with any of /a,i,e/ or /θ/ as version vowel, but the forms in question here require /i/, the syntax would again have to violate the Lexicalist Hypothesis to ensure the correct morphological form.

But once we grant that the rule of Co-referential Version Object Deletion (creating "Subjective Version" Verb forms) is a lexical rule, we have an argument that lexical rules must be able to refer to whether an argument position is filled by a reflexive or not. The rule which we have been discussing applies obligatorily if and only if a benefactive or possessive Indirect Object would otherwise be a "Refl" NP bound by the Subject position of the Verb. Lexical rules must thus have access to co-reference relationships of the sort usually described by the Binding theory – or at least to the subset of such relationships for which we might want to invoke the feature ‘Refl.’

We conclude that a lexical rule of reflexive binding, of the sort proposed
by Di Sciullo and Williams (1987), not only provides an alternative to the apparent syntactic reference to word-internal structure involved in Georgian reflexive causative constructions, but fits quite well with other facts of the language. The apparently ad hoc nature of such a rule which troubled Di Sciullo and Williams does not reflect its real character, at least for this language. In fact, such an account may have important consequences for a properly modular view of the constraints governing the appearance of anaphoric items in natural languages.

We conclude that there is no support for the claim that morphosyntactic operations of the sort discussed by Baker apply as part of the syntax. This, in turn, is consistent with the general conclusion that syntactic operations do not have access to or manipulate the internal form of words (i.e. the Lexicalist Hypothesis as interpreted in the present work). Given this, we conclude that there is no substantive argument to be derived from syntactic considerations for the assignment of word-internal morphological structure as a function of derivation.

10.2.3 Morphological motivation

Rules of the morphology might provide an argument for word-internal morphological structure if they necessarily depended on or manipulated the (non-phonological) internal composition of words. Now in fact the literature on morphological theory has gone to some lengths in recent years to minimize the extent to which such reference could be made. Constraints such as the Adjacency condition of Siegel (1978) and the Strict Cyclicity condition of Lexical Phonology (see Kiparsky 1982a; Kaisse and Shaw 1985; and chapter 9 above) have the effect that morphological operations are prevented from looking at or altering any of the internal structure of a form except the result of the immediately preceding operation. Of course, the consequences of that operation are precisely the properties that characterize the input form itself (regardless of its source), and thus the effect of such conditions is to eliminate the possibility that the morphological composition of a form (as opposed to the positive phonological, morphological, syntactic and semantic properties it bears) can be relevant to the way in which rules can operate on it.

We might find evidence for the presence of structure if we had a rule that, say, inserted affixal material precisely between two morphological units. A rule might infix a particular marker precisely before the final suffix (or after the initial prefix) present in its input form. Such rules do not appear to exist, however: rules of infixation seem always to place their affix with regard to material that can be characterized in phonological terms (see chapter 8 above). Infixes thus appear after (or before) a single consonant, a syllable or syllable nucleus, a prosodic foot, etc., but never after (or before) a single affix regardless
of its phonological shape. This fact suggests that information about the morphological (as opposed to phonological) constituency of words is not available to morphological rules.

What seems initially to be rather a strong argument in favor of providing morphological structure as input to morphological rules has been developed in connection with the operation of rules of truncation. Aronoff (1976) proposes that the affix -ate is deleted before some other affixes, such as -able, in words like demonstrable (from demonstrate). Since instances of the sequence -ate which are not affixes are not truncated (cf. debatable from debate, not *debable), he argues that it is impossible to replace reference to the affix by a purely phonological description. If this argument were to succeed, it would show that truncation rules (can) require information about the morphological structure of words which is not purely phonological.

This argument that truncation is based on morphological and not phonological structure is not particularly secure, however. The absence of forms like *deable, *inflable, etc. would also follow from the observation that truncation applies only to instances of -ate that do not bear primary stress. Furthermore, this affix appears in two classes of words, associated with either 'level I' or 'level II' phonology. The 'level I' forms undergo truncation of -ate, but the 'level II' forms do not: see pairs such as démonstrable (level I) vs. démonstrable (level II). While the (non-truncating) level II formation seems quite productive, the (truncating) level I formation is, as we would expect, somewhat less so. As a result, even in cases where we have no reason to doubt the affixal status of -ate, the only possible form in -able may not show truncation. Consider the word truncate itself, from which we find truncatable but not *truncable; or probate (from Latin probare), from which we have probatable but not *probable. Since not all stems in -ate have level I (i.e. truncating) formations with -able, the absence of, for example, *translatable might thus be merely a lexical gap.

Furthermore, other instances of truncation seem clearly to involve morphological non-constituents. A considerable range of such forms in French is provided by Corbin (1987: 345), including:

(12) a. virus - viral; cactus - cactée; rectum - rectal: tétanos - tétanique
b. liquide - liquéfier - liqueur; stupide - stupéfier - stupéur
c. rigide - rigidifier - rigueur; humide - humidifier - humeur
d. certain - certitude; caillou - caillasse
e. charité - charitable; herédité - heréditaire; vanité - vaniteux
f. adroit - adresse, maladroit - maladresse

The fact that this distinction is presented here in the terms of Lexical Phonology, rather than as, for example, the difference between the phonology of "+ boundary" and "# boundary" affixes, etc. has no significance for the point being made.
In none of these cases have we any reason (apart from truncation) to believe that the truncated material is a morphological unit in French: truncation appears here to be applying to phonologically characterized parts of words. In the absence of clear instances of the situation suggested by Aronoff, where only a morphological specification will identify the truncated material, we conclude that rules of truncation do not provide clear evidence for imposing morphological structure on words.

Another argument is offered by Fabb, who proposes explicitly that "all internal brackets are visible to all suffixes" (Fabb 1988: 533). His justification for this is the claim that English exhibits a number of suffixes that are constrained not to be added to already-suffixed words—a requirement that obviously could not be met unless internally complex words could be distinguished from others. This argument suffers from serious empirical problems, however. In fact, a quick check of such reference works as Marchand 1969 and Jesuperson 1942 turns up examples of already suffixed words that can be further suffixed in virtually all of Fabb's affix classes. Indeed, he himself gives as an example at least one form of this sort: *robbery* as an instance of the formation of Nouns from Noun stems by the suffixation of -y. Some other examples include:

(13) a. N + age\textsubscript{N}: brokerage, porterage, readerage, percentage...
    b. V + ant\textsubscript{Adj}: significant; also radiant, stimulant, etc. with truncation of -ate;
    c. N + ful\textsubscript{Adj}: healthful, truthful, meaningful
    d. N + ism\textsubscript{N}: gangsterism, behaviorism, favoritism, aristotelianism...
    e. N + ize\textsubscript{V}: computerize, puritanize, italianize, signalize...
    f. N, Adj + ly\textsubscript{Adj}: maidenly, scholarly, loverly, northerly, westerly
    g. V + ment\textsubscript{N}: chastisement, aggrandizement, betterment, enlightenment...
    h. N + ous\textsubscript{Adj}: felonious, erroneous, disputatious, flirtatious

All of the affixes cited by Fabb also appear on the second elements of compounds (with scope over the entire compound) and on already prefixed words, even those that are otherwise not widely attested with other affixes.

Fabb's methodology seems to have involved extensive reliance on listing in Walker 1924 as a criterion for the possibility of a formation. As argued extensively by Corbin (1987), dictionary listing is far from being an appropriate measure of the potential domain and range of word-formational processes, and it seems necessary to conclude that no argument of the sort Fabb proposes has actually been made. Indeed, the kind of selection he proposes would be quite unusual: normally subcategorization is for some positive property of the subcategorized element rather than for a purely negative aspect of its structure.

A final argument from this general class is made by Halle in a series of
recent presentations, including Bromberger and Halle 1989. This concerns
the prefixes that mark the person of arguments of the Verb in Georgian.*
The basic observation, as discussed in section 5.3.2 of chapter 5 above, is that
when two such prefixes are called for, only one appears:

(14)  a. mo-v-klav “I will kill him”
      b. mo-g-klav-s “he will kill you”
      c. mo-klav-s “he will kill him”
      d. mo-g-klav “I will kill you” (*mo-v-g-klav, *mo-g-v-klav)

Halle proposes to account for this by having first a set of rules to develop
Object markers (such as /g-/ “2nd person Object”) and then a set of rules to
develop Subject markers (such as /v-/ “1st person Subject”). The
complementarity observed above is then claimed to follow from a restriction
that the Subject-marking rules apply only to unprefixed forms. It appears
that if this is to work, enough structure must be visible to distinguish prefixed
from unprefixed forms.

Halle appears to support the plausibility of this analysis by an appeal to
the fact that in German, the prefix /ge-/ “past participle” (like other prefixes
of the ‘inseparable’ class) is not added to Verbs that already bear a prefix.
As Kiparsky (1966) argued long ago, however, not only Verbs with prefixes
(e.g. besprechen “discuss”) but also those with exceptional non-initial stress
(e.g., riskieren “risk”) have participles without /ge-/ (besprochen and riskiert
respectively). Halle (personal communication) suggests that such cases actually
show the relevance of a native/foreign or learned/popular distinction for the
rules of stress assignment in German: prefixation is actually subject to the
condition that the stem involved be ‘native’ and unprefixed.

While it is indeed true that most of the (unprefixed) stems which have
non-initial stress in German are borrowed, the reverse is not the case. At least
some stems that are transparently non-native are monosyllabic, and thus
(trivially) bear initial stress: for example, boxen “to box,” toasten “to drink
a toast to,” leasen “to lease.”* If it is indeed the non-native character of Verbs
like riskieren that is responsible for the lack of /ge-/ in their past participles,
we would expect these monosyllabic borrowings to behave in the same way.
What we find, however, is that their participles conform to the regular pattern:
geboxt, getoastet, geleast.† We could of course claim that the feature they
bear (e.g., [+ Foreign]) is not in fact the one that is relevant to the prefixation
rule (which might require, for example, [− Learned]), but in that case it is

* A corresponding argument based on Georgian verbal suffixes for person and number is
subject to objections similar to those below.
† The non-native character of the first is suggested by its internal [ks] cluster; that of the
second by the Viennese dialect form toastieren.
‡ I am grateful to Gert Webelhuth for information bearing on this point.
not clear that the diacritic in question ('[−Learned]') has any content other than "bears non-initial stress." We ought in any case to ask what unifies the two conditions claimed to apply to the prefixation rule: 'native' and unprefixed. It seems clear that what these have in common is precisely the fact that they identify the forms in which stress is not assigned to the stem-initial syllable. This observation in turn suggests that the correct generalization makes no reference to internal morphological structure: it is simply that /ge-/ is only attached to stems that bear initial stress.

Regardless of what is true of German, though, Halle's account would be quite interesting if it went through for Georgian. Unfortunately, the proposed condition is simply wrong. We can ignore the fact that Georgian Verbs can also be prefixed with an aspectual preverb (e.g. the /mo-/ in the forms above), where the presence of such a preverb has no effect on whether or not /v-/ can be prefixed. Besides this, as we saw in chapter 6, Georgian Verbs can contain other prefixes: there is an important class, called the "pre-radical vowels," which occur for a variety of reasons, derivational and inflectional. These are surely prefixes, but do not block the appearance of /v-/. Other prefixes mark Indirect Objects. For the first and second persons, these are the same as those marking Direct Objects, but for third person Indirect Objects the situation is more complicated. When the pre-radical vowel appearing before a given Verb stem is /a-/ or /e-/ the third-person Indirect Object is unmarked. When it is /i-/ third-person Indirect Objects are marked by changing this /i-/ to /u-. But when there is no pre-radical vowel, a consonantal prefix marks third-person Indirect Objects, at least in the 'standard' dialect. This is the reflex of Old Georgian /x-, and appears in the modern language as /s- before coronal non-continuants, /h-/ before labial, velar and uvular stops, and as θ elsewhere. Now this prefix has a rather peculiar status: generally its appearance is blocked by the appearance of another prefix (thus, v-txov "I ask him it"). There is some fluctuation, however, and forms such as v-s-txov "I ask him it" also occur. This can be analyzed as a fluctuation in whether the s/h/θ prefix is associated with the other Verb-person prefixes (and thus mutually exclusive with the other person prefixes, giving forms like v-ʻtxov), or with the pre-radical vowels (in which case its appearance is compatible with other prefixes, giving forms like v-s-txov). On Halle's view, it is not clear how the form v-s-txov could be derived, since the /v-/ here appears in an evidently 'prefixed' form. Notice, by the way, that there is absolutely no variation in the case of the other prefixes: g-klav is the only possible form for "I am killing you," and *v-g-klav is completely impossible.

The generalization, then, is not that /v-/ cannot be added to prefixed forms.

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11 See Vamling 1989 for some discussion.
In fact, aspectual prefixes, preradical vowels, and the person marker s/h/θ (for some speakers) can all be prefixed to Verbs without blocking the introduction of /v-. Rather, it is the specific prefix /g-/ (and by implication, perhaps, also /m-/ “1st person singular Object” and /gv-/ “1st person plural object,” though these could never co-occur with first-person Subjects for syntactic reasons) whose incompatibility with /v- must be described. Apparently, then, the condition on the /v- rule must be “does not apply if the /g-/ rule has already applied,” just as the condition on the s/h/θ rule, for those speakers who assign it to the Verb-person prefix class, is “does not apply if the /v-/ rule has already applied.”

In these instances, the condition is thus a matter of the mutually exclusive character of certain specific elements, not a limitation (such as “does not contain a prefix”) on the formal makeup of the stem to which a morphological element is to be added. But is that not exactly the sort of thing which has been claimed above not to occur in grammatical systems? Surely if the account offered above is correct, the grammar of Georgian must be able to identify specific prefixes, a task for which the kind of structure that appears in (1) would appear to be well suited.

The solution to this puzzle, of course, is to treat the relation of exclusiveness between the two prefixes as a matter of disjunction between two rules, rather than as a subcategorization restriction on one of the affixes. A stipulation that two (adjacent) rules are disjunctive in this fashion is quite comparable (though not equivalent) to the more traditional claim that the rules in question belong to the same position class. Such an account of the Georgian facts was proposed in Anderson 1986a (and in section 5.3.2), and Halle’s argument was intended precisely to show that the kind of disjunction claimed there to exist can be replaced with positive conditions on individual rules (much like those offered by Fabb). But if we recognize that the complementarity observed in the Georgian prefixes is a relation between Word Formation Rules, we do not need to assign internal structure to the forms themselves in order to account for the facts.

The point of this discussion is that much of what might be done in the structure-based account by various sorts of subcategorization restriction (assuming that conditions such as “only attaches to morphologically simplex forms” can be stated at all) can be formulated in the structureless theory as matters of the internal organization of a system of rules. Now we clearly need some such organization in any event: relative order of affixes, for example, is reconstructed by the relative order of rules in the sort of system proposed

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12 Again for syntactic reasons, this is the only other verbal agreement prefix that could appear in a form with a third-person Indirect Object that must be marked by s/h/θ.
in this work. But if we were to record morphological structure whenever we perform morphological operations, and (what is more important) allow ourselves to refer to that structure at various points later in the derivation, we would be able to formulate essentially global conditions. Such conditions, making essential reference to arbitrary earlier stages of a derivation, cannot be expressed as conditions on adjacent steps (the conceptual content of ordering restrictions on pairs of rules). There is thus a substantial theoretical advantage to be achieved by pursuing a program on which morphological form is represented as the application of rules, and abandoning the morphological analogs of the Phrase Markers that are so important to syntactic form.

10.2.4 Phonological motivation

It seems, therefore, that if arguments are to be found for assigning internal morphological structure to words, they must come from phonology. Indeed, phonologists have generally been the principal consumers for such structure, which appears in their analyses in several forms. Within the "Standard Theory" of generative phonology (as we saw in chapter 9 above), an inventory of 'boundary' elements of several types appear between morphological elements within a full (syntactically motivated) labeled bracketing giving hierarchical structure. Such a representation allowed for simultaneous access to morphological and semantic form, as well as to a quasi-phonological re-encoding of such form (represented by the differing strength of boundary elements), at all points in the morphological and phonological derivation of a word.

Within more recent theories, such as that of Lexical Phonology (see the references cited above) and the variant of that view that was discussed in chapter 9, the range of available information is greatly reduced. The only non-phonological structure available to the morphology and the phonology is the bracketing of morphological constituents; furthermore, even these brackets are assumed to be erased at some point in order to constrain later reference to included structure. A variation on this picture (from our point of view) is provided by the representations employed in Autosegmental Morphology (McCarthy 1981 and subsequent work): here distinct 'tiers' of a representation contain the phonological content particular to individual morphological units, and the association of two aspects of phonological form with distinct morphological content is reflected in their presence on distinct tiers. On the other hand, it is also assumed that originally distinct tiers are conflated at some point into a single representation. The motivation for this is to constrain later reference to included structure, in a way entirely analogous to the function of bracket erasure in Lexical Phonology.
As we have already discussed, it was recognized early that the amount of structure made available in the 'Standard Theory' was excessive, and that the possible relevance of morphological structure was much more limited than implied by that framework. This has resulted in all subsequent views incorporating (a) a much more parsimonious reference to non-phonological structure in the representations accessible to phonological rules; and (b) overt devices (such as 'bracket erasure' or 'tier conflation') to constrain the range within a derivation where particular pieces of such non-phonological information are in fact available to the phonology.

In terms of such structure-reducing operations (or conventions), we can identify a sort of spectrum of theories about how much morphologically determined structure should be assigned to a representation for the purposes of (a) the phonology; and (b) the morphology. Note that the amount of structure which is motivated might be different in the two domains:

(15) a. A minimal theory would assign no morphological structure to the form whatsoever, taking (the non-semantic side of) morphological operations to map phonological forms into phonological forms.

b. The next step up would be to assign a bracketing to the result of applying a morphological rule, separating the base from any affix added on that cycle, which disappears at the end of the cycle. On this view, the input to a morphological rule does not have morphologically internal structure, but phonological rules do get to see one layer.

c. Next would be to assume that 'bracket erasure' applies at the end of a level, not after each cycle. On this view, both morphological and phonological rules get to see all of the structure developed at the same level within the lexical phonology and morphology, but not structure from prior levels.

d. Finally, one might abandon 'bracket erasure' altogether and assume that morphological rules build structure which is accessible to to later rules in a general way.

_Ceteris paribus_ (which they never are), we should prefer the theory of (15a), since it is the most restrictive. It is therefore incumbent on anyone who believes in something richer to justify it. As we have seen in the previous sections of this chapter, such justification cannot be expected to come from other areas of grammar than phonology.

An argument was given by Allen (1978) that rules should not be allowed to be sensitive to the characteristics of previous cycles: for example, a rule deriving Verbs from Nouns is perfectly possible, but one deriving Verbs only from de-adjectival Nouns should be excluded. This could be effected by a convention that brackets are eliminated at the end of the phonological cycle. Such a theory of Bracket Erasure is adopted by Pesetsky (1979) for instance.

An alternative formulation of this view would be to get along without any
brackets whatsoever. They are not necessary to delimit the stem from the affix for phonological purposes (assuming a formulation of the Derived Environment Condition to be developed below), and they will not be available in all cases (in particular, not for non-affixal morphology). What is really necessary is access to the properties of the (derived) form.

A less restrictive theory of Bracketing Erasure is adopted by Kiparsky (1982a), who suggests that brackets are erased not at the end of a cycle but rather at the end of a stratum of the lexical phonology. His principal reason for suggesting this is the apparent existence of generalizations that depend on access to more than one layer of morphological structure, though not to affixes from more than one stratum. In particular, he suggests that (level II) zero derivation of Verbs from Nouns in English is impossible if some other level II affix has already been added (e.g. *(to) singer). To state this, we apparently need to know not only the properties but the derivational history of a proposed Noun base.

This fact need not be taken as motivation for bracketing, however. Another way of stating the same generalization is: the rule for zero derivation of Verbs from Nouns cannot apply after any other level II rule. This reduces the fact to an ordering relation, not a property of the rule's Structural Description. Kiparsky's view was articulated on the assumption that the morphology is a set of lexical entries (for affixes) which are essentially unordered (except for their assignment to levels of the Lexical Phonology). Apparent ordering restrictions are encoded as parts of their subcategorization requirements. But insofar as these subcategorizations have to refer to particular morphological elements or categories rather than to independently motivated (e.g. lexical) classes, an ordering account seems at least as good - especially if it would allow us to maintain a more restrictive view of Bracketing Erasure.

The argument for allowing structure to persist through a level that is widely cited is Kiparsky's observation about zero derived level II denominal Verbs in English. But the structural constraint Kiparsky assumes can be replaced (at worst) with ordering relations: the rule of zero derivation is the first rule of the level II morphology. Note that it is hard to believe that either the structural constraint or the ordering is actually learnable: perhaps the possibility of rule A following rule B on a level is only posited in the presence of positive evidence (i.e. morphological feeding relations have to be learned, and are not posited automatically). But this too seems unlikely. Probably the real answer lies in some characteristic of rules of 'Conversion' (zero derivation) in general.

The fundamental issue seems to be between the theories of (15a) and (15b). That is, given the devices of cyclic application (including the derived environment condition), is there reason to believe any non-phonological structure is created in a form by the operation of morphological processes?
A class of arguments relevant to the issue of 'bracket erasure' is provided in McCarthy 1986. McCarthy's view of morphology assumes that the segmental content of each morpheme is introduced on a separate tier in the representation, and that a rule of 'Tier Conflation' applies to collapse multiple tiers into a single phonological representation. The distinction between one morpheme and another is represented for him exactly by this difference between tiers, which is destroyed by tier conflation. As a result, tier conflation is directly analogous to bracket erasure. The 'minimal' view of (15a) above translates, in this theory, into the claim that tier conflation precedes the phonology on each cycle.

The arguments in McCarthy 1986 concerning this issue are mostly directed at showing that there is a rule of tier conflation, and that much of the phonology of a language can apply after it. He does give two examples which purport to show that some phonological rule must precede tier conflation, but in fact both of these involve the claim that identical vowels within a cyclic domain are affected uniformly regardless of the intervening consonantism. Assuming vowels and consonants are on separate tiers before tier conflation, and the Obligatory Contour Principle (OCP) requires identical vowels to constitute a single melodic segment at that point, the fact that such a unit is uniformly affected would seem to constitute a real argument: tier conflation breaks up the 'single' vowel melody into the vowels of separated syllables.

The problem with this argument is that one of McCarthy's two examples is a rule from Rotuman, a language in which there is no morphological basis for putting vowels and consonants on separate tiers. This suggests that whatever is going on in these cases, it has more to do with phonological structure than with morphological structure. While there is no reason to believe that vowels and consonants belong on different tiers for morphological reasons in Rotuman, that is, some recent proposals about features suggest that vocalic and consonantal features are in general sufficiently distinct that instances of the one need not destroy the continuity of a spread specification for the other. Thus, McCarthy's examples do not necessarily show that phonological rules precede tier conflation: they may simply argue for a 'two mouth' theory of features.

McCarthy cites a number of other examples that would seem to entail tier structure (equivalent to bracketing structure) within the phonology, but their interpretation depends on the rigidity of the OCP. If the possibility is admitted that 'true geminates' and 'fake geminates' can remain distinct in the phonology, McCarthy's cases of the different behavior of tautomorphemic vs. heteromorphemic geminates can be directly expressed in that way, and the issue of morphological information per se in the phonology need not arise.

Bat-El (1989) cites cases from Modern Hebrew which show, on McCarthy's
assumptions, that distinctions between morphemes may have to persist into representations in which tier conflation has taken place. One of these concerns a metathesis rule that applies to certain clusters of /t + C/ that arise in specific verbal forms. The two consonants have to be on the same tier for such a rule to apply to them, but it is also necessary to know the identity of the morphemes involved. I suspect that this can be accommodated by assigning the metathesis rule (and perhaps a related Voicing-Assimilation rule) to a particular level of the lexical phonology, and invoking the Derived Environment Condition.

As argued above in chapter 9, there are essentially three ways in which morphological structure might be relevant to the operation of a phonological rule.

(16) a. A rule might be constrained to apply only within a given domain, and not over its boundaries.

b. A rule might be constrained to apply precisely at the (right or left) edge of a morphologically delimited domain (i.e. before or after a boundary).

c. A rule might be constrained to apply to a given string only when it contains a boundary between two domains.

In fact, however, within the general framework of a cyclic morphology and phonology, such as that presumed here, accounts exist of all of these kinds of influence that do not invoke morphological structure per se. Historically, these issues have been posed in terms of the theory of boundary elements in phonological representations, and their effects on rules.

If rules apply cyclically, they can only operate on the material contained within the current cycle. Limiting a rule's application to a particular domain can always be achieved by associating it with the cycle introducing some specific new material characterizing that cycle. As a result, it is not necessary to allow explicit reference to boundary elements or hierarchical morphological structure within the Structural Descriptions of individual rules in order to ensure that their scope of application is limited to a single (cyclic) domain.

Allowing the Structural Descriptions of (cyclic) rules to include reference to their end points achieves the effect of a rule that applies only before (or only after) a boundary, so long as the rule applies on the appropriate cycle. It is thus necessary to allow rules to refer to the edges of the forms to which they apply, but (in the context of cyclic application) such reference clearly does not entail the existence of boundaries or other representations of structure within the word itself.

There are a number of subcases to the class of rules that only apply across a boundary, but the most important one potentially is the following: some rules apply to a string /...XYZ.../ if and only if the edge of the previous cyclic domain falls somewhere within XYZ. It turns out that in such cases the precise location of the boundary typically does not matter. Thus such
cases form a subset of a well-studied problem in phonology, that of rules
which apply only in 'derived environments.'

We do not pretend to have a complete, general solution to this fundamental
problem in phonological theory. We wish only to suggest that the basic content
of this notion, on the one hand, can be stated so as not to imply the presence
of explicit word-internal morphological structure that persists after the
operation of Word Formation Rules, and on the other hand, obviates other
sorts of phonological reference to such structure. Consider the following
tentative formulation of a 'Derived Environment' condition:

(17) Where $R$ is a Derived Environment rule, if $R$ would apply to
      /...XYZ.../ on some cycle $i$, motivated by the application of mor-
      phological rule $M$, the application of $R$ is blocked if /...XYZ.../
      was present at the beginning of cycle $i$ (prior to the operation of $M$)
in exactly
      the same form.

This condition assumes that not all rules are subject to it. Perhaps general
principles exist to predict whether or not a rule is a 'Derived Environment'
rule: for instance, it might be the case that all and only cyclic rules are subject
to (17) or its replacement, as assumed in many versions of Lexical Phonology.
On the other hand, some evidence suggests that whether or not a rule is a
'Derived Environment' rule is in part an idiosyncratic property, and so we
leave this possibility open.

The content of such a condition (similar to what was once known as the
Alternation Condition: see Kiparsky 1973b) is that a rule can only apply on
a given cycle in response to something about a form that has changed on
that cycle. We seem to need such a condition in any event, to cover cases in
which no boundary element appears as such; but a large class of apparent
boundary effects can be subsumed under it, removing this additional
motivation for imposing morphological structure on words.

10.3 Conclusion

As will be seen, the thrust of the program assumed here for inter-relating
morphology with phonology, syntax and semantics is to replace reference to
morphological structure within a form by conditions on the structure of the
derivation of a word. It may seem that this is merely a choice between
'notational variants,' but there is arguably much more to it than that.
Conditions on the structure of derivations are inherently local, if we assume
the normal Markovian notion that only the properties of a form, not its
history, can be relevant to rules operating on it. Assigning structure to a form
itself, in contrast, allows broader reference to that structure. Insofar as such broader reference is not in fact found, we need an explanation of why that should be the case – an explanation which is provided immediately by the claim that no such structure is ever created.

We have not, obviously, covered all of the possible arguments that might be found in the literature for the assignment of word-internal structure in a manner similar to the representation in (1). Nonetheless, it seems that a representative range of apparent motivations for such structure are either illusory or susceptible of reformulation in terms that do not require us to assign constituent structure internal to words. The overall message is the following: if we treat the morphology of a word as the way in which it is related to other words through a system of rules, rather than the way it can be assembled out of morphemes into an internally complex structure, we account naturally for the paucity of reference to such structure in the principles of natural language. We can also maintain the minimal (and hence ideal) theory that what we see when we look into the structure of a word is what we get: an association of sound with meaning (and syntax). Punkt. There is no question of where brackets or boundaries are erased, or tiers conflated, because there are no brackets or boundaries to be erased (or tiers to be conflated).

If we could motivate the existence of word-internal morphological structure, this would be a significant point about the nature of language, since such structure (as opposed to the phonological and semantic content of words) is not at all patent. Rather, it is only inferred from the relation of words to one another; and what we have seen is that once we have described the relations themselves (which must be done in any event), the further step of attributing additional internal form to the items that are related is probably unnecessary. It is always a matter of considerable intellectual interest and satisfaction to be able to show that the structure of some aspect of reality is actually very abstract, and only indirectly related to its appearance through a chain of inferences. It can be a matter of even greater satisfaction, however, to show that in fact the world is just as it appears to be, and nothing more.
11 Composites: words with internal structure

Of the several types of word formation recognized in the 'classical' morphological tradition, one important one remains to be treated here: the formation of compounds. In its traditional sense, compounding differs from derivation and inflection in quite a straightforward way. It consists in the combination of (two or more) existing words into a new word, while derivation (as well as inflection) consists in the application of a Word Formation Rule to a single existing word. Within a theory based on the morphotactic combination of morphemes, the differences between these mechanisms seem minimal. Both involve the combining of morphemes; the elements combined in a compound happen to enjoy independent status; while at most one of the elements combined in derivation is autonomous, but this seems more of a convenient division in terminology than an essential difference of type.

In a word-based theory employing Word Formation Rules and denying to 'morphemes' the status of independent lexical items, though, the difference seems much more prominent. A Word Formation Rule, recall, operates on a single word (or stem) to manipulate its phonological form (typically, but not exclusively, by affixation) as well as its other properties. Compounding, in contrast, involves the combining of stems from the lexicon into a quasi-syntactic structure. This word-internal structure seems to be unique to compounds, in fact. We argued above in chapter 10 that the only structure which seems motivated internal to non-compound words is a phonological one, representing the metrical and other sound-based relations among its subparts rather than an internal syntactic form. The formation of compounds seems to involve a genuinely syntactic combination of lexical elements below the level of the word (perhaps along lines like those explored in Selkirk 1982), while non-compounds have only a phonological structure. The position we adopt here thus accepts (in part) the notions of Selkirk and others about the internal form of some words (compounds, as well as a limited generalization of that class to be considered below), while rejecting the attempt within that program to extend such word-internal syntactic structure to all relations between formatives in a way that would closely parallel the views of American structuralist morphotactics.
Apart from the independent lexical status of their constituents, other arguments also support the suggestion that compounding is (at least in part) a process of word-internal syntax. For example, the elements of compounds typically fill (rather than merely absorb) argument positions in the semantics of other elements: cf. cutthroat, dogcatcher. The relation between compound elements and the argument frames of their co-constituents has been studied by Roeper and Siegel (1978), Lieber (1983a), and others. It is clear that whatever the principles governing the internal relations of these elements, they are syntactic in a way which is somewhat different from other aspects of morphology.

Furthermore, it is precisely when compounding is involved that it has been argued to be necessary to invoke the device of 'looping back' in the lexical phonology of a language. This refers to the necessity of allowing forms that have undergone rules at a late level of the lexicon to serve as input to rules of earlier levels (see Mohanan 1982; Halle and Mohanan 1985). Such a notion obviously evacuates the strong claim of a level-ordered morphology, and as such should be resisted. Even if we do not accept the Affix Ordering Generalization, as suggested in chapter 9 above, the rule interactions that arise within compounds (taken as wholes) violate the relations that are otherwise well motivated within (non-compound) lexical items.

If compounding in fact involves the combining of lexical stems into new word structures, however, this is just what we might expect. There is every reason to believe that the stems combined, as lexical items, will already have undergone rules at various levels; but a newly formed compound might itself then be subject to phonological adjustments appropriate to all levels of the lexicon, including comparatively deep ones. The point is that the mechanism of compounding is unlike that of (other) word formation, in that it involves the combining of lexical stems into a syntactic structure rather than an operation on a single base stem.

The present chapter deals with the fact that unlike affixed words, compounds do provide motivation for assigning internal structure to words. A generalization of the notion of compound to that of composite words will be suggested. Composites are in general produced by the operation of a set of Word Structure Rules, distinct from Word Formation Rules. The notion of 'headedness' that obtains in word-internal structure will also be discussed. A set of Word Formation Rules that build a limited kind of internal structure will be suggested and exemplified, and some other issues that have been raised in the previous literature with regard to the structure of internally complex words will be discussed.
11.1 Compounds and their structure

We can begin from the position of Selkirk (1982), which is that morphologically complex words are created by an extension of rules of phrase structure to a set of word-internal categories (such as root, stem, suffix, etc.) In the preceding chapters, we have rejected such a treatment for ordinary derived and inflected words; and indeed, there is really no explicit argument for this account in the literature on morphology as word-internal syntax, apart from the largely implicit observation that it would allow us to assimilate one class of rules (those of word structure) to another (those of phrase structure). In Selkirk’s treatment of compounds, however, as opposed to her analysis of affixed words, it appears there is an argument for assigning internal structure to complex words. Specifically, when we create a compound, the result belongs to some lexical category (not necessarily that of any of its parts), and it fills the same slots as non-compound members of the same category.

As the lexical occupant of a structural position in a syntactic structure, such as (most importantly) the head of a syntactic phrasal category, a compound can be assigned morphosyntactic inflectional features within the syntax. Where are these features to be realized, however? Selkirk’s answer is that compound words have internal grammatical structure, and that these structures are headed as proposed by Williams (1981b). The features of the whole word and those of the element that constitutes its head must agree, which means that those features assigned to the whole compound must also be present on its head, similar to the operation of the ‘Head Feature Convention’ which we saw in chapter 5.

Now since heads are usually on the right in English compounds, and inflectional features are realized as suffixes, it is hard to be sure in cases such as plural search parties or past-tense outlasted whether the inflection is structurally present on the head or simply on the whole compound. But when the head happens to take an irregular inflection, it becomes clear that it is this element that bears the inflection: cf. scrubwomen, outdid. The point here is that it must be possible to find the lexical items woman and do in these forms in order to inflect them properly. But that, in turn, implies that the compounds scrubwoman and outdo have some internal structure. Furthermore, these inflectional feature(s) can also be passed down to non-initial heads, in

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1 Assuming, of course, that it were possible to carry out such an analysis. As we have argued repeatedly above, not all of the structurally significant components of words have a non-arbitrary status as ‘constituents’, so we contend the proposed extension of phrase-structure devices to encompass word structure in general is based on a misconception.
the rare cases (in English) where such constituents seem to be motivated: thus *sons in law, men of war, passers by*.

Importantly, for (potentially) irregular items at the right edge of a compound, it makes a difference whether the element is the head of the compound or not, even when the locus of inflection for the compound form is also at this edge. As observed by Kiparsky (1982a), compounds of the 'bahuvrihi' type (one of the subtypes of exocentric structures, none of whose constituent parts is identifiable as the head of the complex word) take regular inflection regardless of their constituents: cf. *saber teeth* (a variety of tigers, hence exocentric) vs. *milk teeth* (a kind of teeth, hence endocentric). This follows if we say that a compound's features need be passed down ('percolated' in Selkirk's terminology) only to its head constituent. Kiparsky proposes to analyze bahuvrihi constructions by assigning them a structure with a phonologically null head, but this matter of execution is not important here. Whether some such null item is head of the compound or not, the structure must contain at least enough information to make it clear that *tooth* is not the head of *saber tooth(s)*.

This is not absolute: sometimes the inflectional property *is* passed to a rightmost non-head in bahuvrihi compounds like *tenderfoot* ("inexperienced beginner") or *flatfoot* ("policeman"), for which both *tenderfoots* and *tenderfeet, flatfoots* and *flatfeet* seem to be available as plurals. This shows us something about the rules for the transmission of features within a structure, though it does not impugn the claim that these compounds have internal structure. If anything, it strengthens it.

The prediction is that other exocentric types, such as Verb-Noun combinations like *pickpocket, scarecrow, turnkey, know-nothing*, etc., would behave the same way as *saber tooth* and inflect for plurality by means of the regular *-/z/* rule and not by using some lexically specified irregular plural form of their rightmost member. Unfortunately, there do not appear to be any such words that end in irregularly inflected Nouns (*tooth, mouse, child, man*, etc.) by which we could test this.

In other languages with more overt inflection, the inflectional features may be passed down to non-heads as well as heads. Many Icelandic place names are Adjective-Noun compounds for instance, and both parts get inflected for case: cf. *Breidi-fjörður* "Broad-firth," genitive *Breiðafjarðar*. Note that this extension of inflection to both parts shows that the first (non-head) part of the compound, as well as the second is an identifiable structural unit.

From these considerations, we conclude that at least some words apparently have a structure which is not purely phonological in character; and further-

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2 This is also the analysis of Marchand (1969), more or less.
more, that a notion of head is applicable to some (perhaps most plausibly, to at most one) of the overt constituents of a word. This structure is relevant to the morphology, in that it can serve as the basis for 'transmitting' the marking of a morphosyntactic property from an entire element to one of its subconstituents.

It would seem natural to accommodate the facts surveyed thus far by distinguishing the formation of compounds from that of non-compounds. In contrast with the basic mechanisms of derivation and inflection, therefore, we propose to let compounding be accomplished not by the operation of Word Formation Rules, but rather as syntactically structured objects described by phrase-structure rules such as (1) which describes the formation of Noun compounds both of whose constituent parts are Nouns.

(1) \[ N \rightarrow NN \]

In this formulation, we use underlining to indicate the head (if any). We take it to be a matter of individual rules whether the structure they describe has a head or not; and if so, where this element is located. Of course, the position of the head in formations within a given language may conform to some broad generalization (e.g. 'heads are the rightmost element') in most (though perhaps not all) cases, but it does not seem possible to elevate these tendencies to a universally applicable principle. We will return to the question of the location of heads in English below.

Rules such as (1) are similar, though not identical, to rules of the standard \( \mathcal{X} \) system. Thus, if they define a head, it is always a member of the lowest bar level of the same type as the whole structure (i.e. only N can be head of a compound N, V of a compound V, etc.); that is, headed compounds are categorial projections of their heads just as headed phrases are. On the other hand, Word Structure Rules need not define a head, in which case the word as a whole cannot be regarded as a projection of one of its constituents. Furthermore, within words any sisters of the head themselves belong to lexical categories. This is in contrast with the situation in phrasal syntax, where within a phrase the sisters of the head are usually taken to be limited to maximal (phrasal) projections.

If we claim that compounds are basically generated as syntactic structures, rather than by Word Formation Rules, how can we account for the presence of special morphological material in them? For example, in the German compound Schwanengesang "swan song," the two elements Schwan and gesang are joined by an element /-an-/ which has no discernible purpose apart from serving as 'glue' in the compound. Note in particular that this element is not an ending (e.g. a genitive marker) on Schwan, since this Noun forms its genitive in /-s/ (cf. phrasal der Gesang des Schwans "the song of the swan"), and there is no form *Schwanen in the paradigm of Schwan outside of compounds.
The answer to this problem does not require us to recognize Word Formation Rules that create compounds, but only that we recognize such rules that apply to them. Thus German and many other languages have Word Formation Rules that perform changes like that in (2).

(2) \([N [nX] [nY]] - [N [nX]^{en-} [nY]]\)

A rule of this sort applies only to compounds (by virtue of its Structural Description), but the compounds it applies to are structures whose formation takes place elsewhere – either in the lexicon or in the syntax. Rule (2) makes no change in word class, semantics, or any other non-phonological property. Such semantically empty Word Formation Rules are not restricted to these cases, however: witness the rule cited in chapter 4 in (the Beijing dialect of) Mandarin that suffixes -er quite freely without any identifiable semantics.

In any case, Word Formation Rules that specifically apply to compounds are not always semantically empty. Again from Mandarin, there is a rule that takes compounds like 堪見 “look at–perceive: see” and infixes de or bu to yield a modal sense. We thus have 堪de见 “can see” and 堪bu见 “cannot see.” This is a rule that applies exclusively to compounds of the form \([v [vX] [vY]]\), again providing evidence for analyzable word-internal structure.

Naturally, many compounds are not created syntactically but rather reside in the lexicon (where their idiosyncrasies of sense, etc., are stored). Some of these lexical compounds will contain bound forms of the familiar cranberry morph type. Note that we do not have to say that the lexicon contains a distinct item cran- so long as it contains \([n [ncran] [nberry]]\) with the appropriate sense of the whole. On the same basis, we can say that English prefix–stem combinations are present in the lexicon in structurally analyzed form, but the individual prefixes and stems are not. This is another case in which structure has to be accessible somehow, so that we can identify the -ceive of receive, deceive, etc., as the same in each instance (in order for Word Formation Rules that apply to these verbs to get the special allomorphy right in reception, deception, etc.).

On the basis of these lexicalized complex forms, we can suggest that languages have rules of analogical compound formation. That is, given the compounds \([N [nX] [nY]]\) and \([N [nX] [nZ]]\), such a rule provides the license for coining \([N [nX] [nY]]\). The semantics of such words is presumably arrived at by a sort of ‘triangulation’ from what we know about the meanings of the parts and the wholes that we already have.

The point of these remarks is not at all to present a complete theory of Word Formation Rules applying to compounds, or of analogical rules of compound formation, since no such theory has been developed in any
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comprehensive form at present. Rather, we mean simply to suggest that word-based morphology can survive a variety of problematic examples that might seem to motivate the assumption that word formation in general creates structure, provided the theory admits a class of structured compounds, a class of Word Formation Rules that can refer to this structure, and a class of rules that form compounds analogically on the basis of other compounds. For instance, a class of problems related to those above is posed by examples such as Sino-Japanese (friendship treaty). Here we certainly do not want to claim that Sino- is a word (or that the parts of productive technical compounds like erythromycin, etc. are either), but these elements still seem to turn up in newly formed words. The alternative of saying that there is a Word Formation Rule of 'Sino-prefixing' or the like also seems thoroughly unpalatable. Neither of these moves is necessary, however, assuming that we have some compounds in our lexicon whose parts do not occur independently. These compounds then can serve as the foundation from which others can be formed analogically.

So does all this mean that we have abandoned the claim of chapter 10 that words do not have internal non-phonetic (or non-phonological) structure? Yes and no. We do, apparently, have to recognize the possibility of such structure, but this does not entail the further claim that morphological rules in general should create it. Word Formation Rules do not build structure, that is, unless explicitly stipulated to do so. And the motivation for word-internal non-phonetic structure is not the mere fact that some Word Formation Rule has applied in creating the word, but rather the fact that the structure in question is referred to by a rule of the morphology (or of the syntax, if feature percolation within compounds is properly described in that part of the grammar).

The fundamental motivation for word-internal structure is the fact that compounds are a sort of mixed category between words and phrases: they are made up of words, but they belong to lexical (not phrasal) categories. This, it appears, is the place where Selkirk's notion of a word-internal phrase-structure grammar makes sense – though one that does not invoke any categories (such as 'root,' 'stem,' 'affix,' etc.) other than those at the 'word' level. The structure in question also needs a relation of 'head' that cannot simply be read off from the categorial structure of a form in the way we can determine that N is necessarily the head within N, etc. This latter conclusion follows from the fact that a word may have no head, or it may have more than one constituent of the same category as the whole word, etc.

Assuming that such structure exists, it is clearly referenced (where it exists) in a number of morphological rules. For example, German Verbs of the form [v [p an] [v greifen]] "seize" form their past participles according to the regular rules of the language – applied to the stem Verb alone, not to the whole
complex: angegriffen, where the Ablaut is appropriate to the strong Verb greifen and the prefix is attached to this stem.

11.2 Generalizing the notion of “compound”

In the preceding section, we proposed that while Word Formation Rules are not in the general case structure-building (at least they do not assign morphological structure that is accessible to other rules or principles), some words must be assigned internal structure. The canonical case of this sort is that of compounds, as traditionally construed: words made up of other words. We proposed that these should be assigned a structure by a set of Word Structure Rules, quite distinct from Word Formation Rules. Such rules have much the same form as phrase-structure rules, but apply only to lexical categories. Word Structure Rules operate to specify the internal constituency of lexical categories and (optionally) their heads.

The same kind of internal structure can be extended to items already in the lexicon like English pseudo-compounds based on bound combining forms (Sino-Japanese, erythromycin, etc.); and also for prefix-stem combinations (receive, perceive, etc.). This account also entails the existence of rules of analogy or lexical inter-substitution which yield new internally complex lexical items built on the same pattern when necessary. These mechanisms are presumably lexical rather than syntactic, and there is no reason to believe the syntax cares one way or another about differences in formation between these words and others.

The proposal just made involves assigning the sort of internal structure that appears within compounds to forms where the constituents are not independently attested words. Let us then call the larger class of words with internal structure composites, with those cases formed directly by Word Structure Rules from independent words constituting the special subclass of compounds as standardly conceived.

Given such a notion of ‘composite’ structure, the question naturally arises in individual cases of whether the internal complexity of a structure is due to its formation within the syntax, or to its status as a ‘composite.’ One such example is that of German separably prefixed Verbs (e.g. [v [p ab] [v schießen]] “shoot off, shoot down”). These are not far from ordinary compounds, though it seems that some sort of syntactic mechanism must be able to see the category labels on the head Verb and the prefix. In a structure like Sie schossen das Flugzeug ab “They shot the airplane down,” the Verb moves to second position leaving the Preposition in place. This fact, plus the fact that the infinitival form has zu in the middle (Es ist schwer, solche Flugzeuge abzuschießen “It’s tough to
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shoot down such airplanes"), suggest that these are really more like English phrasal Verbs (pick out, shoot down, throw up, etc.), differing in that the German particles are (a) prefixed and (b) simple clitics of some sort.

German inseparably prefixed Verbs (e.g. [verfinden] "invent, discover") represent the opposite situation, where it is not the source but the very existence of word-internal structure that is at issue. Here, the syntax does not see internal structure in these words, but it appears that the morphology does. This is because the Ablaut patterns of inseparably prefixed Verbs generally follow those of their base Verbs (e.g. erfinden, erfand, erfunden parallel to finden, fand, gefunden), which would seem to motivate a structure from which the identity of this base Verb can be recovered. A further argument would be provided by the traditional analysis of their past participles, according to which the prefix ge is added by a rule that applies only when no prefix is present (thus blocking *ergefunden, *geerfunden).

The second of these points has already been addressed above in chapter 10, where it was argued that the correct generalization about the prefix ge is that this is not added to stems whose initial syllable is unstressed. With respect to the similarity in paradigm that exists between prefixed and unprefixed Verbs, this does not in fact require us to assume that the prefixes constitute accessible morphological structure.

Let us note first of all that the Ablaut patterns of German strong Verbs are not directly produced by productive rules, since there is no way of telling in general from the shape of a stem what pattern it will follow. The 'principal parts' of these Verbs must thus be listed in the lexicon. Of course, since the range of patterns the Verbs display is limited, there must be some rules involved that express these regularities; but these appear to have the character of redundancy rules relating stems within a lexical paradigm, rather than Word Formation Rules that operate on a single basic stem to produce its inflected forms.

Let us now consider the properties of inseparably prefixed Verbs. We assume that the existence of classes of Verbs including items like erfinden is related to the existence of a (derivational) Word Formation Rule whose phonological component\textsuperscript{3} is something like (3).

\begin{equation}
\left[ v \right] X \leftrightarrow \left[ v e r X \right]
\end{equation}

Now if a rule like (3) simply related one base form to another (mapping, for example, finden$\leftrightarrow$erfinden), we would need to be able to find the stem finden within the derived form erfinden in order to determine its Ablaut class. But in

\textsuperscript{3} Since the semantic and syntactic relations between Verbs and their prefixed counterparts are not in general completely predictable, the rule in question may not have determinate contents in these domains.
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fact, this is not even the most natural interpretation of (3). This rule relates Verb stems to other Verb stems; and if the lexical entry for *finden* in fact involves the three stems [vfind], [vfand], [vfund(an)] as suggested by the lexical nature of Ablaut, we would expect all three stems to be subject to the rule, yielding the set [verfind], [verfand], [verfund(an)]. The point, that is, is that a rule like (3) can be regarded as mapping paradigms (i.e. related sets of lexical stems) to other paradigms and not simply individual forms to other individual forms. An argument for exactly this understanding of the operation of Word Formation Rules is provided by the account of Icelandic ‘-st Verbs’ in Anderson 1990a. But in that event, we do not need to attribute internal structure to *erfinden* since the Ablaut class of the basic Verb *finden* is preserved under this mapping.

To complete this account, we need only note that unlike Ablaut patterns, the occurrence of the prefix *ge* in past participles is predictable and thus due to the operation of a productive Word Formation Rule. As a result, this prefix is not present in the lexical form for either [vfund(an)] or [verfund(an)]. The rule applies to the first of these (since it bears the Morphosyntactic features of a past participle) but not to the second which, while it bears the correct features, does not meet the Structural Description of the rule by virtue of its initial unstressed syllable.

German Verbs with prefixes, then, whether these are separable or inseparable, are not analyzed as composite word forms with word-internal structure. In the separable case, the structure is fully syntactic in character, parallel to English Verb–particle constructions and differing only in that the ‘particles’ are phonologically simple clitics attaching to the following word unless the Verb stem has been moved. In the inseparable case, the prefixes are fully integrated into the phonological form of the Verb, and the prefix simply marks the existence of a lexical relationship to other Verbs. The two cases are structurally quite disparate, though there are obvious superficial similarities. In some cases, we find reanalyses of particles as prefixes: thus [v übersetzen] “to translate” is inseparable, while [über] [vsetzen] “to set across” (which appears to represent a renewal of the structure from which the former Verb derives historically) is separable. The reanalysis can be regarded as involving precisely a loss of internal structure in übersetzen “translate” following on the development of an increasingly opaque relation to setzen “set.”

A better candidate for a composite structure analysis is probably the class of Georgian verbs with aspectual preverbs (e.g. [vmo [vklav]] “kill (perfective).” Here there is no reason to believe that the syntax can see into the word, but the morphology must be able to, as we have seen in various places above: much of the inflectional morphology of Georgian involves rules that prefix material to the word-internal stem.
The cases of non-compound composites considered above all involve prefixes, but that is surely accidental. Other cases that should be included involve suffixes, such as the 'middle-voice' Verbs in -st in Icelandic analyzed in Anderson 1990a. The Verb klaðast "to dress (oneself)" can be assigned a structure like [v, [v, klaða][st]], where the -st element represents the reflex of an old reflexive pronoun. When such a form is inflected, the inflectional material (for tense, mood, person/number) goes on the stem as if the suffix were not there (though there is some phonological interaction): kallast "be called, named (something)," við kölluðumst "we were called ..." The stem with the middle-voice material constitutes a lexical entry, however, since many of these have idiosyncratic properties. There is no reason to believe that the syntax can see anything in a middle-voice form except the fact that it is a Verb, and the correct analysis seems to be one that treats them as composites.

Similar but somewhat more complicated is the case of Russian reflexive verbs such as kazat's'a "seem." These have a suffix -s'(a), originally descended from a cliticized reflexive pronoun but now lexicalized (just as in the Icelandic case). Inflectional material goes on the stem alone. These Verbs, however, can also have a peripheral non-head prefix added to them to make the perfective stem: thus, the perfective of "seem" is something like [v, po[v, [v, kazat]'s'a]]. Again, the internal structure is relevant to the morphology of inflection but not (in itself) to the syntax.

In the Icelandic and Russian examples, it is clear that many of the composite forms involved are lexically idiosyncratic. It is also clear that others are created by the operation of synchronic Word Formation Rules. In Icelandic there are productive readings associated with newly created middles (reflexive, reciprocal, or passive, depending on the semantics of the individual Verb). Russian Verbs in -s'(a) are similar. In both cases, the non-phonological components of the relevant Word Formation Rules usually involve absorption of a 0-role.

In these and other cases of composites (including the subclass of these structures constituted by true compounds), we can assume either that the agreement, etc., rules of the language are formulated to apply specifically to the head of an internally complex structure, or else that the features 'percolate' to that head and then the rule applies only within the inner domain (similar to English washerwomen).

The internal structure of composites when specified by Word Structure Rules assigns labels to both subconstituents of a form, as in compounds and

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4 Or perhaps 'all', if more than two subconstituents are possible at the same level of structure within a word. We have no clear evidence to decide for or against a restriction of composite structure to binary branching, although Mandarin compounds such as ji-yà-yú-ròu "animal foodstuffs" (literally "chicken-duck-fish-meat") would appear to provide a good prima facie case for non-binary structure.
pseudo-compounds. The case of structure assigned by Word Formation Rules appears to be somewhat different, however.

While Word Formation Rules have been argued (here and in chapter 10) not to create structure in general, they can in particular cases be stipulated to create internal structure. Known cases seem to involve the creation of headed structures in which (internal to the resulting word) only the base form bears a category label. In the Georgian, Icelandic and Russian cases of non-compound composites considered above, it is not clear that there is any motivated syntactic category to which to assign the peripheral element. Fortunately there is no reason to assign it to any category at all: what is necessary is merely to treat the inner Verb as itself a structural element within the composite. It is also necessary to make the labeled element the head; this would seem to follow naturally from the formulation of the relevant Word Formation rules as adjoining unlabeled phonological material to a category-bearing base. It seems to be true that the only possibilities for head-less composites are found within the domain of true compounds, as we might well expect given the intrinsic headedness of structures (like those in Georgian, Icelandic, Russian, etc.) formed by adjunction.

Although it appears reasonable to constrain Word Formation Rules not to introduce subordinate category levels, it is not clear whether or not such rules must preserve the category membership of their base. A category-changing structure-building rule might have a Structural Change such as that in (4).

\[(4) \quad [nX] \rightarrow [v\text{foo} [\lambda X]]\]

Examples such as (4) seem not to be attested, but since Word Formation Rules can both change category and build structure, it would be nice to know why they apparently cannot do both at once.

A function of the composite analysis of words like Georgian prefixed Verbs, Icelandic and Russian middle or reflexive Verbs, etc. is that inflectional material may be realized by a rule that operates not on the entire form, but rather on the head of a composite. On the other hand, some rules inflect the whole (outermost) word regardless of its composite status. Furthermore, this difference is a parameter in the formulation of particular rules, and not a uniform feature within an entire language. Examples are provided from Alabama in Chiu (1987) of rules within the same grammatical domain (agreement inflection in Verbs, whose stems Chiu shows to be generally composite in structure) that differ as to whether their Structural Change applies to the entire composite base or only to its head stem.

When applying to composites, which have an analyzable internal structure, it is necessary to ensure that rules apply either to the entire form, or to its internal head, but not to both at once, since this sort of multiple inflection is not
found: for example, English does not have plurals like *washerwomens, nor does Georgian have first-person verbal forms like *v-mo-v-klav ("1st-preverb-1st-stem"). One might be tempted to regard this lack of multiple marking as an instance of disjunctive ordering (i.e. to see it as related to the fact that *mens is also impossible); but probably it simply follows from the fact that a rule's Structural Description specifies application either to the head or to the whole word, but not both.

The analysis of some words in some languages as composites reduces the class of possible infixation processes. We noted above in chapter 10 that languages never seem to have rules such as "infix α before the last suffix that has been added," although we might expect such rules to be quite possible if constituent structure were built as an automatic consequence of the application of Word Formation Rules. In fact, since we clearly have to be able to affix to the head of a word, but we do not find this sort of 'before(/after) the last(/first) affix' mode of infixation, this would seem to be an argument against the notion that affixes (specifically rightmost affixes) are the heads of their words, an issue that will be taken up below.

On the view that words have no non-phonological structure which is accessible to other rules, all principles for the placement of affixes ought to be purely phonological. By and large, this has been seen above to be correct, but there are some instances in which the morphology of the form seems to be relevant to affix placement, such as the person-marking prefixes of Georgian Verbs that are attached directly to the Verb stem in a way that ignores an aspectual prefix if one is present. There is no apparent phonological definition of this position: the person markers go at the very beginning of non-prefixed forms, regardless of their syllabic or other phonological structure, and are only 'infixed' if the form contains an aspectual prefix; the prefixes after which the markers go may be either monosyllabic or bisyllabic and may be stressed or unstressed. In the face of such examples, we must evidently admit a limited presence of structure-building operations in Word Formation. We propose that such structure is confined to the possibility that Word Formation Rules may be stipulated to effect adjunction of affixal material (thus yielding the structure \([x [x \ldots ] \ldots ]\)) instead of the usual phonological concatenation. In addition, in the case of compounds, other internal structure may be present lexically (or built syntactically by the operation of Word Structure Rules).

In chapter 8 above, we proposed a set of parameters for the placement of affixes within a word, which we repeat below as (5).

(5) a. The affix is located in the scope of some constituent which constitutes its domain. This may be either a morphological constituent (the

\[ Thus, /a-, av-, avmo-, ga-, gan-, ga(r)da-\] etc., are all possible prefixes.\]
word-structural head of a composite vs. the entire word) or a prosodic one (prosodic word).

b. The affix is located by reference to the {beginning vs. end vs. head} of the constituent in which it appears. The ‘anchoring’ element is a prosodic subconstituent at some level (segment, syllable rhyme or nucleus, syllable, or possibly foot).

c. The affix {precedes vs. follows} the reference point.

On the basis of the examples examined here, it seems that affixation never needs to identify any non-phonological aspect of a word’s structure except to specify its domain as being the head of the word as opposed to the entire word. It thus appears that an organization of some words into a head and a non-head periphery is all the structure that is warranted in the output of Word Formation Rules. This is still not ideal (since it would obviously be preferable to prohibit structure-building altogether), but at least it does not imply that every Word Formation Rule that applies leaves its structure behind for later rules (potentially) to access.

11.3 Word-internal structure and theories of the lexicon

The general position adopted here is that relations among words are not to be represented in terms of organized structures that may share common elements (classical morphemes), but rather in terms of Word Formation Rules that map whole forms (including whole phonological representations) onto other whole forms. We have argued explicitly that word internal structure of a non-phonological sort is in general superfluous. Nonetheless, in the preceding section we recognized that some Word Formation Rules may (as an unusual, stipulated property) create limited word-internal organization (accessible in principle to other rules) if they adjoin (rather than merely concatenate) new phonological material with a base on which they operate.

Somewhat more seriously, it might appear, we have also recognized the creation of words with explicit internal structure through the operation of a class of syntactic Word Structure Rules: essentially, rules which develop lexical categories in terms of other lexical categories in order to account for the form and properties of compounds (including some natural extensions of this traditional notion). Furthermore, we have acknowledged the fact that some such internally structured lexical items must be ‘in the lexicon,’ in the sense that their properties are (at least in part) learned individually like the properties of other words, rather than projected by rule as in the case of purely syntactic constructions. But this admission of some syntactically structured items to the category of “words,” and even to the lexicon, clearly makes the distinctions
among syntax, lexicon, and morphology, as well as between word and phrase, as problematic as ever.

In the present section we discuss a number of issues in this area, picking up the discussion of the nature of lexical knowledge in chapter 7 above. The starting point here will be the discussion of Di Sciullo and Williams (1987), a rather conservative presentation of a morphological theory based on the structured organization of morphemes into words. The rather extended analysis here of the position presented in that relatively short work reflects its status as one of the most serious treatments of basic issues in the theory of word structure to be found in the current literature.

The stated goal of Di Sciullo and Williams's work is to disentangle several variously founded notions of 'word,' as distinguished in (6).

(6) *Lexical word* (‘Listeme’) – an item that has to be entered in the lexicon, where this is construed as the repository of all (and only) information about linguistic objects that is arbitrary and has to be memorized because it does not follow from general principles; *Morphological word* (‘Morphological Object’) – an item whose internal composition and structure is given by the set of strictly morphological principles of the language (which describe compounds and affixed words); *Syntactic word* (‘Syntactic Atom’) – an item that is treated as internally unanalyzable by the syntax; and *Phonological word* – an item assigned to a specific category in a prosodic hierarchy.

Since the notion of 'Morphological Object' here is rather narrow, they also admit a class of 'Non-morphological Objects.' These are structures that are generated in the syntax, but analyzable (either entirely, or 'co-analyzed') as instantiating a lexical category position.

There is of course a massive literature on the notion of 'word,' most of which is not explicitly addressed by Di Sciullo and Williams. However, much of that literature is devoted precisely to arguing that (roughly) the distinguishable notions of 'word' in (6) do not converge on a single class of objects. From that observation some authors conclude that the notion of 'word' is incoherent, others that it is simply multifarious. The difference between these two reactions is not ultimately very significant.

Let us begin with the relation between 'listedness' and 'the lexicon.' Uncontroversially, many things about words must be learned (and presumably listed) *ad hoc*: for example, the fact that there is a Noun with phonological form /dog/ and semantic interpretation 'DOG.' The question remains, however, of whether this list is co-extensive with a grammatically interesting set.

One candidate for such a set would be the totality of those items that are

*That is, one closer than many others to views with which the present author can often agree.*
available to lexically interpret the terminal nodes of a syntactic Phrase Marker. The view of Jackendoff (1975), for instance, was essentially that all of the words available for this purpose are present in the lexicon; morphological rules are construed there as redundancy rules which assign an internal structure to this list. This picture effectively characterizes the lexicon by equating it, on the one hand, with the union of the set of listemes and the set of morphological objects (in Di Sciullo and Williams’s sense); and on the other, with the set of syntactic atoms.

Di Sciullo and Williams reject this view, but for reasons that are in part terminological. First, they seem to want to use the word ‘lexicon’ for the set of listemes; and in this sense, “the lexicon is like a prison – it contains only the lawless, and the only thing its inmates have in common is lawlessness” (1987: 3). One must be careful not to exaggerate this conclusion: like other prisons, the lexicon in this sense contains a number of inmates convicted only of relatively minor crimes. But still, it is reasonable to deny that this set has any interesting property relevant to the rest of the grammar beyond that of idiosyncrasy.

In Jackendoff’s usage, though, the ‘lexicon’ was not confined to an enumeration of forms that are in some way exceptional: rather, it includes the compositional forms as well as the idiosyncratic. The two types are differentiated by saying that fully compositional words are cost free, while idiosyncratic ones are not – to exactly the extent their properties cannot be deduced by rule. The rules themselves, then, serve as a cost function over the inventory of possible words. Facts about words that derive from their conformity to the regularities of the language are thereby attributed directly to those regularities, and the informational cost of an individual word is taken to be a function of the extent of its genuinely idiosyncratic features.

Di Sciullo and Williams object to “the idea that the rules of morphology are essentially redundancy rules over a finite set of objects in a way the syntactic rules are not.” (1987: 3). In context, this is a rejection of the claims that

Words but not phrases occur among the set of listed items;
The words of a language can be explicitly enumerated, and thus must be finite in number; and
The domain of morphological principles is exactly this finite set.

In fact, however, none of these claims is part of the real theories of the lexicon which are supposedly being argued against.

All coherent theories of the lexicon admit (though few emphasize) that syntactic idioms (e.g. buy the farm “become a casualty”) must be listed too:

7 Perhaps the mild semantic noncompositionality of drinkable in the sense “good (not merely suitable) to drink” is a grammatical misdemeanor.
that is precisely the property that makes them 'idiomatic.' Some writers make this admission more gracefully than others, of course, depending on how much of a theory of idioms they have. Jackendoff (1987), for example, views the 'meaning' component of a 'lexical item' as simply a specific rule relating phonological form to conceptual form. On this view, idioms that are regular in syntactic form but non-compositional in meaning (apparently the vast majority of such items) simply correspond to specific projection rules that operate on phrasal (not just lexical) categories with specified internal makeup. An account is still required for idioms that are idiosyncratic in form and not only in sense (e.g. by and large): these seem generally to be listed members of phrasal categories with syntactically opaque internal structure.

Similarly, everyone knows that the set of possible words in a language is not always finite. 'Polysynthetic' languages, like K'ak'wa'ala or the Eskimo-Aleut languages, have no upper bound on word length, and a fortiori none on vocabulary size. But Jackendoff, even in speaking about English (where the point is probably also valid, though not so obvious), says that aside from serving to capture the regularities of the words that are listed, the rules of morphology serve to allow the addition of new words, and thus their scope cannot be confined to some antecedently given (and hence finite) list. If we construe the 'lexicon' not extensionally as a set of words, but rather intensively as a form of knowledge, as suggested in chapter 7, this is an entirely natural view.

Di Sciullo and Williams bring up yet another notion of what 'lexicon' might mean, distinct both from 'the set of listemes' and from 'the word space of the language': what they call the 'psychological lexicon.' This is the set of words which a speaker can be said to 'know' on the basis of acquaintance. Obviously all the listemes (or at least the ones a particular speaker has come across) are on this list (for that speaker), but so are a number of other forms that are not idiosyncratic at all. Just which forms are 'listed' in this sense "will vary from speaker to speaker, determined by such factors as [a word's] frequency of use in the speaker's daily life" (1987: 7). The interest of this notion for, say, the psychologist interested in lexical processing is apparent. For the grammarian, on the other hand, that would not appear to be the case, for there is no particular reason to believe that this set has any special status with respect to the grammar.

For one who insists on construing the 'lexicon' extensionally, there are thus a number of equally coherent possible senses that might be given to this notion. Some of these can be arranged in a roughly ascending scale of inclusiveness as in (7).

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* See the discussion at the beginning of chapter 7 and references cited there for some further distinctions in the sense of 'lexicon' that have been made in the literature.
(7) a. The set of (at least partially) idiosyncratic items, or 'listemes';
b. The inventory of actual words known to a particular speaker at a
particular time, or that speaker's 'psychological lexicon,' including (but
not limited to) the idiosyncratic ones in (a);
c. The inventory of items that conform to the language's regularities of
word structure, or 'morphological objects': this is the set of words that
can be projected from the set in (a) by virtue of the morphological rules
of the language; and
d. The inventory of words available to a given speaker that could occupy
(or interpret) lexical category level positions in a syntactic representation,
consisting of the union of (b) and (c).

We can call the set in (7c) above the 'virtual' lexicon of a language in a
sense vaguely similar to that of 'virtual memory' in a computer: it is the set
of things that can be addressed at need, but that are not actually in memory
at present.

But we are not quite finished with the poor word 'lexicon' yet. Within the
theory of Lexical Phonology, this is a component of the grammar; construed
as a set, that notion corresponds to the set of items whose form is within the
domain of the lexical phonological rules. An interesting empirical proposal
would be the claim that this set is co-extensive with one defined as in (7d).
But on the view taken in this book, regular inflection is actually performed
as part of the process by which lexical items interpret syntactic positions, by
rules which apply to pairs \{S, M\} consisting of a stem and a morphosyntactic
representation (derived in the syntax). In that case, the lexicon (in the sense
of the domain of the lexical phonology) will include the regularly inflected
forms of items, since lexical phonological rules clearly operate to determine
the form of regularly inflected items in many languages. In that case, however,
the domain of such rules will be greater than the range of stems specified as (7d).

If the notion of ‘word’ is not one that converges on the same definition
from all points of view, there is no reason to doubt that several candidates
for the definition of ‘lexicon’ will also exist. The point is that none of the
issues discussed thus far are really other than terminological, since there is
general agreement on the content of the various notions of the lexicon just
noted and the inter-relationships among them. On the other hand, it is possible
to question whether any of these conceptions actually succeeds in identifying
a set which is clearly delimited and of genuine linguistic interest. Again,
construal of the lexicon as a form of knowledge (represented by a system of
rules) rather than as an inventory seems to lead to a clearer theoretical focus.
11.4 The notion ‘head of a word’

We might conclude (on the basis of evidence presented so far) that the morphological regularities of a language which define its morphological objects could be presented in the form of a set of Word Formation Rules that apply to items in a speaker's psychological lexicon either passively, as suggested by Aronoff (1976) and Jackendoff (1975), to yield an analysis of an item insofar as it has one; or actively, to project the dictionary from the psychological lexicon. Di Sciullo and Williams, however, argue (or rather, assume) that the description of the set of morphological objects takes the form of a set of rules that define possible word structures, together with a list of morphemes each of which has the properties of a lexical item (including subcategorization requirements that define its range of combinability). This is clearly a theory on which all complex words have internal structure assigned to them.

We have already considered the case of compound structures. There is no question that the parts of a compound are lexical entries — that is essentially definitional, in fact — and there is little quarrel with the claim that compounds have internal structure. The question that remains is whether affixed words are of the same type. One hint that affixes are different in status from parts of a compound is to be found in the literature of Lexical Phonology: Kiparsky (1982b) notes, in a discussion of whether morphology is a set of rules or a set of morphemes, that affixes in themselves do not constitute cyclic domains. Now he claims that the real generalization is that bound morphemes are not cyclic domains. But if we think of the lexicon as an inventory of morphemes, what explains this observation?

Consider the nature of bound morphemes, elements that cannot appear by themselves in isolation as words but are always either affixes to other words or parts of lexicalized composites (like cranberry). The generalization would seem to be that a ‘cyclic domain’ includes precisely what appears as an entry in the lexicon (either basically, or by virtue of projecting a new item from an old by means of a Word Formation Rule). But in that case, affixes should not be lexical entries, which furnishes an additional argument against taking affixed words necessarily to have internal structure.

In the present section, we take up a central aspect of a number of current theories that assign internal structure to affixed words: the notion of head, which is intended to account for the relation between the properties of a word (as a whole) and the properties of its parts. The basic idea is that the head of a word should be that one of its constituent parts that determines its properties. Properties of the head should be inherited by (or 'percolate to')
the word as a whole, while the properties of non-heads are not inherited. Taking this notion of head very literally, we are confronted with the fact that it is often (indeed, typically) the case that some affix is responsible for assigning the properties of an affixed word. We note the fact that *fish* is a Noun, but *fishy* is an Adjective; presumably the property of being an Adjective must have come from somewhere. Wherever it came from, that must be the head (by assumption). Since it is clearly the addition of the affix -y that is responsible for the lexical category of *fishy*, it follows on this reasoning that -y must itself be an Adjective, and the head of the word.

Now as we have already had occasion to note above, *whatever* notion of head we adopt for internally structured words is unlikely to be the same as the one we normally assume in phrasal structures. Within phrases, one of the points of X-theory is precisely that the head of a constituent X\textsuperscript{n} is the single constituent of type X\textsuperscript{n-1} that X\textsuperscript{n} contains. In words, on the other hand, the analog of such a definition ("the head of X\textsuperscript{o} is the single X\textsuperscript{o} that it contains") will not in general be uniquely satisfied. Some new notion would thus be needed.

In the theory of composites developed earlier in this chapter, a necessary condition for being the head of a word was assumed: the head of a word X\textsuperscript{o} must itself be a constituent of type X\textsuperscript{o}. But this clearly is not a sufficient condition, given (a) the possibility that we might want to describe exocentric, or headless structures; and (b) that there might be two (or even more) elements of category X\textsuperscript{o} within the same composite word. It was therefore assumed that Word Structure Rules must simply stipulate some one of their possible heads as the actual head (in endocentric structures).

Williams, however,\(^9\) has taken the position that one can give a necessary and sufficient definition for identifying the head of a word. At least for English (the degree of universality claimed for this is unclear), the head is said always to be the rightmost constituent. If affixes are treated uniformly as structural constituents of words, this yields as a consequence the claim that the head of a word is the rightmost suffix within it, and never a prefix. Thus, -y is the head of *fishy* but counter- could not be the head of *counterspy*, since prefixes are never at the right edge of a word and thus must always be category neutral.

As a claim about word structure, this is simply incorrect, even if confined

\(^9\) Or perhaps "the single X^{-1} that it contains." Theories that attempt to extend X-theory to word-internal structure generally posit additional levels of structure below that of the basic lexical categories. We will not examine the basis for such claims here; and in any case, they are irrelevant to the analysis of compounds where the constituents will in general belong to lexical categories of type X\textsuperscript{o}.

\(^{10}\) See Williams 1981b, Di Sciullo and Williams 1987 and elsewhere. Bauer (1990) has recently argued against the utility and consistency of Williams's notion of 'head' in morphology on grounds that are partially similar to those adduced below.
to English. It is true that most English prefixes (of which there are not all that many, if we ignore composite Verbs composed of a prefix and a stem, such as *invade, pervade, permit, commit*, etc.) are category neutral, but this is not true of all of them, as shown by examples such as the denominal (or in the case of *enlarge*, de-adjectival) Verbs in (8).

(8)  
- *be-* bewitch, beguile, beribbon, bejewel, befather  
- *de-* deflea, delouse, defeather, dethrone, decipher  
- *en-* enthrone, empower, enslave; imprison; enlarge, enfeeble, enrich, ennoble, enable

There are also cases in which a prefix, while not determining the lexical category of the word, still determines some property of it that on this view should derive from its head, such as its subcategorization or the way it assigns interpretations to its arguments. Thus, in *bemoan, beweep, bewail* the prefix *be-* yields transitive Verbs from intransitive ones. Verbs with the prefix *inter-* can be used intransitively (*interpenetrate, interlock*) in ways that are not available to the basic Verbs. *Smear* can assign θ-roles either as in *John smeared paint on the floor* or as in *John smeared the floor with paint*, but *besmear* can only assign θ-roles as in *John besmeared the floor* (*with paint*).

This is not to suggest that no account of such phenomena is available on the view that affixed words always have a head, and that this is always their rightmost affix. In Williams 1981b it is suggested that sometimes affixes come in pairs, where one of them is 'potentiated' by the other. Thus, in *ennoblement*, we have a Noun derived ultimately from an Adjective, a derivation which crucially involves the prefix *en-.* Williams argues that *-ment* is still the head of this Noun, and that the role of *en-* is merely to potentiate that affix. On that line, we could always say that prefixes with the apparent properties of heads are just parts of a pair with a θ-suffix; and that it is the latter which is really the head of the word. In the absence of positive evidence in favor of these θ-suffixes in each case, however, the ultimate effect of this move is to render the claim of the 'right-hand head rule' completely vacuous.

Still, in most cases of derivation involving clearly identifiable suffixes, the properties of the word as a whole indeed appear to be those that we would expect on the basis of the last suffix. If this conclusion is correct, how are we to derive it on a theory which does not assign word-internal structure to affixed words?

Within a theory based on Word Formation Rules, changes in lexical category, subcategorization, θ-role assignment, etc., are part of the Structural Change of a Word Formation Rule. Each Word Formation Rule applies to lexical items that may be the result of the application of other Word Formation Rules, but clearly the last one to apply ‘wins’ in the sense that its effects are
not obscured by those of other rules. In a form containing multiple suffixes, the linear order of suffixes clearly mirrors (in the terminology of Baker 1985b) the order of application of Word Formation Rules in the derivation of the word. Thus, the rightmost suffix usually wins not because it is the rightmost, but because it corresponds to the outermost layer of word formation.

On this view, it is simply a fact about English that most prefixes do not change syntactic properties. The few that do are unremarkable in any cross-linguistic sense: they are only unusual for English prefixes. On Williams's view, on the other hand, the existence of any such items would require that the theory be either radically changed or completely evacuated.

Not only category-changing prefixes but also category-neutral suffixes are problematic for the view of 'heads of words' in Williams 1981b and Di Sciullo and Williams 1987. One of the early objections to this definition was the observation of Jaeggli (1980) that the Spanish diminutive suffix -ito can be added indifferently to members of various lexical categories without changing their category (or any other property except their semantics). Not wishing to posit a whole series of homophonous suffixes -ito belonging to different categories (but otherwise the same), Jaeggli naturally prefers to adopt an analysis on which -ito is simply unspecified for lexical category (or any other syntactic property). But in that case, a theory incorporating the 'right-hand head rule' needs some other way to avoid the conclusion that Spanish words ending in -ito are similarly unspecified for syntactic properties.

The move that Di Sciullo and Williams make here is to replace the original notion of the head of a word with that of a 'relativized head': that is, 'head with respect to a given property.' This is defined as the rightmost constituent of a word that is specified for the property in question. In this way, some suffixes can be regarded simply as being transparent for some properties: if the relevant property is not specified, then its value will be determined by the preceding suffix. Furthermore, something that is the head of a word with respect to one property may not be the head with respect to some other property.

Notice that the notion of relativized head still does not help with the cases of syntactically relevant prefixes in English, since the stem of such prefixed words will in general be specified for a property like word class. Thus, in [en [ntomb]], specifying the prefix en- as a Verb still does not allow it to determine the lexical category of the whole word, since the lexically specified base [ntomb] follows it in the word. The stem in such cases should not be transparent on Williams's definition, and the prefix still has no way to determine the class of the derived word.

Di Sciullo and Williams (1987) also wish to deny that there is a principled difference in the place of inflection and derivation in the architecture of
Composites: words with internal structure

grammar, and propose that the notion of 'head' can be used to derive the theorem that (syntactically relevant) inflection is 'outside of' derivation, without requiring a distinction between the two categories. This follows from the fact that inflectional properties clearly must be transmitted (or in their terms, 'percolated' up) to the word as a whole, since it is only there, on their view, that the syntax could see them for purposes of agreement, case marking, etc. They thus must be properties of the head of the word, and that in turn entails their being rightmost suffixes.

Within complex inflectional systems, multiple affixes may mark multiple inflectional categories, where more than one such category may have to be visible to the syntax. Consider Finnish taloissamme "in our houses," with the analysis /talo + i + ssa + mme/ "house - plural - inessive - our." Here the rightmost suffix only marks the person and number of the possessor, with case being determined by the penultimate suffix and number by the antepenultimate. Since the case and number of inflected words must be visible to the syntax in order to assign correct agreement elsewhere, some way must be found to let the properties of these (non-final) affixes determine those of the whole word. Of course, this will not be the result if the rightmost affix is the (exclusive) head of the word. The relativized notion of head is intended to solve this problem by allowing each affix to be left unspecified for (and thus transparent to) those properties that are marked by the others.

But this yields a new (apparent) problem: in English compounds like parks department, the first element is apparently marked for plural, while the second is not. In that case, why is the plural marker on parks not the head of the word for plurality, since it is the rightmost element that is overtly specified for this property? The natural move here is apparently to assume that department is in fact specified as [—Plural], and so this is the rightmost marked element, and thus the relative 'head' with respect to the property of plurality.

This move simply takes us out of the frying pan and into the fire, however, since it entails that all (or virtually all) derivational affixes also must be assigned some default value for every inflectional category, since there may be no subsequent affix (in the absence of an abundance of theory-vitiating 0s, of course) to specify the inflectional category of unmarked forms. And since derivational affixes bear such inflectional specifications, these will be present even in cases, like some paradigms in Latin, where every value of the relevant category is also marked by an overt inflectional affix. And in that case, the 'inflection outside of derivation' theorem cannot any longer be derived, since there is no reason that an inflectional affix marking (at least the default value of) the category should come outside of, rather than internal to, derivational material. We would thus expect that overt markers of default inflectional
values, when present, would in at least some languages appear internal to derivation, a conclusion that seems to be at variance with the facts.

Another problem that follows from the preceding observations is the lack of a way to characterize regular stems as genuinely unmarked with respect to properties for which they inflect regularly. That is, we would like to be able to say that some stems are marked [+Plural] (irregular plurals and pluralia tantum Nouns like scissors), a few are marked as [−Plural] even though they end in -s (e.g. news, linguistics, measles), but most are just unmarked for this property, and thus can be used wherever either a singular or a plural is called for. The issue here is whether the property [+Plural] as it is marked on such words is a property of the lexical item or the syntactic structure. It appears that a three-way distinction is motivated: this argues against the requirement that every stem bear a default specification for inflectional properties such as [+Plural], and thus against the notion of relativized head that Di Sciullo and Williams develop.

Another issue raised within the tradition of studies based on the 'right-hand head rule' concerns the 'internal syntax' of compounds: the ways in which relations between elements of compounds are (or are not) similar to relations between phrases, and of how the argument structures of compounds as a whole can be computed from the argument structures of their parts. The notion of 'head' plays a role in a set of basic principles, as distilled in (9) from the discussion in Di Sciullo and Williams 1987 where they are claimed to follow from other aspects of such a theory.

(9) a. A non-head may but need not satisfy one of the arguments of the head.
   b. It cannot satisfy the external argument (basically, the argument that would be the Subject of the corresponding syntactic item).
   c. The arguments of the non-head are not part of the argument structure of the compound.
   d. Only the external argument of the head is part of the argument structure of the compound.

In all of these formulations, identification of the head is essential. A wider study of compounds, though, would seem to suggest that there is still work to be done. For example, in some compounds, the 'head' (both on the definition of this as the rightmost word-internal constituent, and in the rather vaguer, semantically founded sense of 'head' characteristic of the traditional literature) satisfies an argument of a non-head: treadmill, pushbutton, drawbridge.

11 Where such an unmarked stem is used for a plural, of course, the result is that the regular rules of inflection in the language will add the suffix /z/. This matter of surface realization should not be treated as a fact about the lexical specification of the stem, however.
punchball, callgirl, etc.; drinking water, eating apple, chewing gum, spending money, etc. It is not clear whether Di Sciullo and Williams want to exclude this situation or not. In some compounds, in contrast to what is suggested in (9), it seems hard to avoid the conclusion that the non-head does satisfy the 'external argument' of the head: sunrise, beesting, earthquake, landslide, heartbeat, sound change, toothache, birdsong, etc. There are even cases in which it appears that the 'head' is satisfying the external argument of the 'non-head': crybaby, glowworm, driftwood, turntable, flashlight, playboy, workman; working party, firing squad, washing machine.

'Headedness' (and indeed 'relativised right headedness') is an important property of "morphological objects" for Di Sciullo and Williams. Therefore, in the case of words that seem to be members of some lexical category from a syntactic point of view (and that are not internally analyzed by the syntax), but that do not seem to satisfy the definition of headedness, some other account is required. This would seem to include (in English) bahuvrihi compounds like paperback, butterfingers, birdbrain etc.; 'Romance' Verb-Object compounds like pickpocket, scarecrow, punch card; apparently left-headed items like passer(s)-by, mother(s)-in-law, man/men-of-war; coordinate compunds (not really found in English, but common in some other languages like Chinese), and possibly others. The somewhat remarkable account offered by Di Sciullo and Williams (1987) is to say that these are not really compounds: that is, they are not really made by rules of word formation, but rather by phrasal rules, together with a general rule of conversion such as that in (10).

(10) \( N \rightarrow XP \)

It is by no means completely clear just how and when this rule is intended to apply, but apparently it permits the grammar to take any phrase (actually any maximal projection) and treat it as a word. Now since some languages (such as French) have many word forms that belong to the class for which the 'right-hand head rule' does not work, and few if any for which it does, the result is to claim that, for example, French does not have compounds at all: rather it has these 'non-morphological objects,' or phrases treated as words.

The argument for this unusual proposal has two parts. First, at least in French, some closed-class items such as Determiners and Prepositions that are characteristic of phrasal structures appear in compounds like trompe-l'œil, monte-en-l'air, bon-à-rien, arc-en-ciel, hors-la-loi. If compounds are structures made up independently of the structure of phrases, such phrase-like structure would not be expected to appear. In contrast, if the 'compounds' in question are really phrasal in origin, this is exactly what we would predict.

Secondly, it appears as if many of the principles of phrasal syntax (for
example, principles of phrasal structure and relative order, case theory, etc.) also obtain within the apparent compounds in French. But syntax and morphology are quite separate domains of grammatical structure; therefore it would be mistaken to assume that the same principles could govern both domains. Instead, we should conclude that the words in question (French 'compounds') are actually constructed by the syntax, and that is why they conform to its principles.

The cost here seems massive. First of all, it suggests that all of the recursive internal structure of phrases ought to be available within French 'compounds.' If this were indeed, true, we would then need to explain why 'words' like *pense sans doute que la terre est plate* "doubtless thinks that the world is flat" are quite impossible. Note that only a few things are independently excluded from taking place within words (specific reference outside the word, for instance). There are a great many syntactically possible structures that do not violate these independently motivated restrictions (exceeding the referential possibilities available within words, for example), but which cannot be instantiated within words. For example, on the 'conversion' view, why are there generally no modifiers to Nouns in compounds of these types (e.g., *pickouterpocket, *arc-en-ciel-bleu), etc., etc., etc.

The other side of this coin is the fact that these compounds are often thoroughly ill-formed as phrases. Thus, *pickpocket* has no Determiner on the supposed Object, despite the fact that English Verbs cannot take Determiner-less (singular) Nouns as their Objects. *Dvandva* compounds systematically lack conjunctions, even though some languages (e.g. Japanese) with such compounds require conjunctions in co-ordinate phrases. Again, the range of syntactic principles violated by non-right-headed compound structures can be considerably extended. The conclusion must be that the formation of words, including compounds (and other composites), is a matter of Word Formation Rules and Word Structure Rules that have their own substance, and not of the reclassification of phrasal structures as words.

Notice that the unfortunate consequences just discussed follow directly from the assumption that all words have an internal head, which can be located by general principles. This entails that apparently headless words, or ones whose heads are located otherwise than at the right edge, must not in fact be 'words' at all. It would seem much more straightforward simply to recognize that headedness is a property whose presence and location in a compounding rule is stipulated as part of the rule, though of course broad generalizations may be applicable to most or even all of the rules within a given language. The observation that some apparently phrasal material may appear within word-like structures is not well accommodated by the assumption of a general rule of conversion like (10), which in fact raises more
problems that it solves. It seems simply to be a fact that some compounds have complicated structures, such as that of French [s [sarc] [sen] [sciell]], etc. Apparently, a satisfyingly homogeneous picture of compounds depends only on the assumption that headedness is a property of Word Structure Rules, and not an independently definable property of word-internal configurations.

11.5 Summary and conclusion

We began this chapter with a consideration of some reasons to believe that at least one traditional category of words, namely compounds, do indeed have internal constituent structure despite the arguments of chapter 10 (and elsewhere) that such structure should not be assigned to words in general. To accommodate the structure of compounds, we proposed that the syntax includes Word Structure Rules that can develop lexical categories. These are similar to phrase-structure rules but have rather different properties with respect to the notions of \( \mathcal{X} \)-theory.

Since the lexicon describes some irreducibly phrasal structures (in the case of idioms), there is no reason to doubt that internally structured compounds can also be present there, even in cases where one (or more) of the elements contained within the structure are not independently available as lexical items. This is the case for 'psuedo-compounds' like Italo-American or tetraethyl, and an additional class of rules of analogy over lexical structures was tentatively suggested to describe the extent to which this class can be semi-productively extended. The properties of such rules remain, at present, a project for future research, but the idea seems more promising than the assumption of independent lexical status for items like Italo-, tetra-, etc.

In addition to compounds and pseudo-compounds, we have found reason to believe that a few types of word formation in some languages may exceptionally yield internally structured forms. We suggested as a result that Word Formation Rules may exceptionally stipulate the introduction of new phonological material by adjunction, rather than the normal operation of concatenation.\(^{12}\) This suggests a generalization of the class of 'compounds' to that of 'composites,' inclusive of all members of lexical (i.e. \( X^0 \)) categories with non-phonological internal constituent structure.

All of these matters of the internal structure of words, and of the devices

\(^{12}\) Given the richness of structure assumed in current theories of the internal organization of phonological representation, it is not at all clear that 'concatenation' is the right word here. We intend only to indicate that the normal effect of a Word Formation Rule on the shape of a form does not introduce any structure beyond the sort of phonology associated with underived forms.
by which theories of word structure reflect their composition and properties, are related to the broad issue of how we ought to interpret the nature of the lexicon within the theory of grammar. We have seen that there are a number of reasons to think of the lexicon as a kind of knowledge, represented by a system of rules (including many that are extremely specific), rather than as denoting some set of actual or potential words. As in the case of the grammar of phrasal structures, it is not even clear that the notion of the object of inquiry as a set (as opposed to the range of knowledge underlying our intuitions about what is and is not in such a set) is a coherent or well-defined one in the study of word structure.

Finally, we considered one notion for which an appeal to word-internal structure seems necessary, that of the 'head' of a word. In the case of affixed words (and in general, the results of the operation of Word Formation Rules), the issues of inheritance of properties for which this notion is supposed to be useful are quite adequately resolved by the inherent nature of Word Formation Rules, and there is no reason to assume that such forms have internal heads. In the case of compounds (and more generally, composites), the traditional notion of an internal head may have a role to play; but there is no reason to believe that all words of this sort have a 'head,' or that when they do, there is a single uniformity of structure that allows us to identify its position within the words. Moves intended to maintain this view result in otherwise unnecessary further difficulties which suggest that they are misguided. Rather, we propose that the status of some element internal to a compound as its head is a parameter of the formulation of the rule. Like other parametric aspects of grammatical systems, it may well be the case that the 'setting' of this parameter generally obeys substantial regularities within a particular language, though such regularities do not appear to be absolute in nature.
One might think that the morphological systems of natural languages are sufficiently complex to justify the study of morphology as an object of interest in its own right. There is, however, another motivation which has sometimes driven the investigation of this area of linguistic structure: the desire to classify languages into (some small number of) distinct 'types.' In fact, much of the terminology which we inherit from traditional grammar in the domain of word structure was originally devised in the service of such classification.

The present chapter is concerned with the nature of the enterprise of typological classification of languages on the basis of their systems of word structure. The basis for this discussion is the set of proposals made by Edward Sapir. In his little book *Language* (Sapir 1921), he presented one of the most detailed typological schemas ever proposed for the word structure of natural languages, basing his discussion primarily on non-Indo-European material. He also believed deeply in the importance of such an analysis. For example, much of his proposed classification of the languages of North and South America rested not on evidence of the traditional comparative sort, but rather on his perception of typological similarities among languages. While he certainly did not believe that such structural similarities were a sure guide to genetic relationship, he did feel that once the core features of a language's structural type had been identified, these were the properties that were most likely to remain (and to have remained) stable over time. As such, they could be a guide even to rather remote relationships, in the absence of other evidence; and 'typology' for Sapir seems to have been pretty much the same thing as 'morphological typology.' On the basis of an analysis of Sapir's schematization of morphological structure, we will then conclude with some more general remarks about the relation between 'language typology' and 'linguistic theory,' arguing that in the end the two are effectively the same if done seriously.

12.1 Goals of a morphological typology of languages

The exact nature of the connection between classical discussions of language types and the current work of those dealing in morphological theory is not
immediately self-evident. On the one hand, contemporary linguists are quite agreed in their contempt for the superficial and naive attempts of eighteenth- and nineteenth-century linguists and philosophers to articulate an understanding of the range of diversity of the world’s languages. On the other hand, while everyone talks about languages as belonging to some or another particular type, and of such and such a feature as ‘typologically significant’, there does not seem to have been any serious attempt since Sapir’s in 1921 to develop a comprehensive view of just what the range of linguistic types might be in the area of word structure. Even today, when people talk about the type to which a language belongs morphologically, they are as likely as not to intend by this one of the nineteenth-century labels ‘agglutinating,’ ‘inflectional,’ ‘polysynthetic,’ and the like: labels that Sapir had hoped to improve on.

Of course, everyone can agree that a valid classificatory scheme for natural languages – one that succeeded in isolating the essential and largely unchanging features of individual languages, as Sapir wished – would indeed be a worthwhile accomplishment. But it appears that such a high-minded goal has not in fact been achieved on the basis of features of word-structure systems, by Sapir or by anyone else; and it is in fact highly unlikely that it ever will be. Words have the form they do because of the syntactic structures into which they are organized; because of the phonological exigencies of the language; and especially (following the remarks which will be developed in chapter 13 below, as well as discussions such as Hagège 1990) because of the individual histories of particular languages with respect both to grammar and to sound. While it is certainly possible (and indeed interesting) to study the properties of morphological systems, it is unlikely that these systems per se, standing as they do in a position where they are subject to so many other influences, will turn out to have genuinely autonomous properties that will reveal the true ‘genius’ of a language.

In the earlier history of typologizing, though, at the time when a linguistic type was of necessity a morphological type (because neither syntax nor phonology in the modern sense had really been discovered yet), there was a tendency to see the goals of typological study in relation to a supposed teleology in language change. Some early (and not particularly lamented) typologists, who took the linguistic structure of Greek, Latin, and/or Sanskrit to represent the acme of human intellectual organization, saw the role of typology as providing an account of the evolutionary stages by which the spirit of mankind had risen out of the primeval slime of isolating-ness to pass through the stages of agglutination and polysynthesis to arrive at the ultimate goal of inflection. Sapir compared this approach to that of the “zoologist that sees in the organic world a huge conspiracy to evolve the race horse or the Jersey cow” (Sapir 1921: 124), and there is no particular reason to soften
that judgment now. Especially in light of the fact that attested changes go in all directions among the classical morphological types, there is no reason at all to imagine that such a typology will serve as a guide to the orientation of linguistic change, even if it does turn out to serve some other purpose.

But if it is indeed so unlikely that typology will show us the path of a stadial evolution of languages, why do we bother to do it at all, and what does a typology really amount to? While one sometimes gets the impression that a typology is simply a taxonomy - a classificatory scheme intended to provide a convenient set of labels for roughly equal subclasses of languages - that obviously cannot be correct; or at least if it is, it describes an enquiry of singularly little intellectual interest.

To see this, suppose someone were to propose the following classification: (a) those languages in which the root meaning "tongue" begins with a [+Coronal] segment are to be called 'iconic': (b) those languages in which the root for "tongue" begins with a [−Coronal] segment are to be called 'anti-iconic': and (c) those languages in which there is more than one root for "tongue," belonging to different classes, or in which there is no basic root for this notion at all, are to be called 'transitional.' Without attempting to tabulate the languages of the world that would belong to each of these classes, suppose for the moment that such a count revealed roughly equal numbers of languages in each set. Still, no one would (or should!) take this proposal seriously. But why not?

Presumably, what makes such a proposal blatantly silly is the fact that nothing at all follows from the phonological composition of the root for "tongue" in a language, except for something about the way sentences sound which involve talk about tongues. The early typologists at least had the idea that something would follow from determining whether a language was 'isolating,' 'agglutinative,' etc.: namely, some predictions about what was likely to happen to it in the next round of linguistic change. If we now have serious reservations about the utility of that terminology, this is presumably because we are pretty sure that those consequences do not, indeed, follow: that is, the traditional terms do not really characterize a teleology inherent in language development. Our doubts do not spring from problems about how to apply the labels (although this may in fact be a far from trivial matter as many writers, including Hagège [1990], have made clear).

We can conclude that the parameters of a typology ought to be ones from which something follows: that is, they ought to identify groups of properties that co-vary with one another, so that knowing how one thing works entails knowing about others as well, as a direct consequence of whatever it is that motivates the typological labels. This is certainly the sense that typology (at least good typology ...) has had in syntax. For instance, the alacrity with
12.1 Goals of morphological typology

which the syntactician strives to know immediately, for any language under discussion, whether it is SVO, SOV, or VSO (or perhaps one of the other possibilities brought forcefully to our attention by Derbyshire and Pullum 1981), comes from the fact that at least since the work of Greenberg (1963), we have felt confident that knowing the relative order of the main constituents of a simple transitive main clause will allow us to predict a whole host of other things, ranging from the relative order of modifiers and their heads all the way down (for some, at least) to whether the language is more likely to have a rule of Vowel Harmony or one of Palatalization.

But the best typological work in syntax certainly does not stop at identifying an inventory of correlated properties. When we find a number of things that appear to go together in a 'typologically significant' way, Inquiring Minds Want to Know: Why? And the form that the answer to this question most generally takes is the development of a framework for grammatical description that will provide a relatively limited number of dimensions along which variation is possible in the systems of individual languages, with each dimension allowing only a small number of possibilities. Such a framework should then make a number of individual consequences follow from the setting of each of these 'parameters' in a given way. Sticking to the example of word order, the X-theory of phrase structure is a descriptive schema for the internal organization of syntactic units as all being in a sort of harmony with one another, subject only to a few options, such as "heads are phrase-final" (vs. "heads are phrase-initial"). If this is indeed true, the X-theory of phrase structure can be regarded as attempting a genuinely explanatory account of how and why particular subfacts correlate in the way they do within individual languages.

When we have achieved such a result, we are entitled to say we have (at least part of) a substantial typology, where the range of language types is then defined by the range of available parameter settings. Insofar as there are not many possible settings, there will not be very many possible types; and insofar as the world's languages avail themselves in roughly equal numbers of the available options, they will distribute in roughly equal fashion among the types. We can then use the parameter values themselves as convenient labels for the resulting typological categories.

It makes excellent sense, however, to ask just how likely it is that a situation comparable to that hypothesized in syntax will in fact turn out to obtain in morphology. How plausible is it, that is, that the system of Word Formation Rules in a language will turn out to be globally parameterized in the way syntactic structure seems to be, as implied in any serious search for a morphologically based typology of languages? Some efforts have been made along these lines by, for instance, those who think of morphology as the
syntax of words and who focus on a program of extending essentially syntactic insights to domains within the word. Regardless of how one feels about the ultimate productivity of this enterprise on its own terms, it still leaves most of the more mechanical side of word formation – getting the segments right and getting them in the right places – largely untouched.

When one turns to the details of how words are composed of phonological material, an immediate impression is that the number of substantial correlations within a language that could give rise to a productive parameterization of the sort sketched above is actually very limited. Much of the reason for this (as stressed in the other chapters of this book) is the fact that word structure is not really an autonomous domain in the same way syntax and phonology are. Much more of what one finds in morphological systems is the result of the interplay of other areas of grammar, and especially of diachronic change; and it is in these other domains that the basic parameters of a language's structure are presumably to be sought. However interesting it may be to study, much of morphology may in some sense be an epiphenomenon.

To shift the emphasis of the discussion somewhat, though, and despite the rather pessimistic attitude suggested above toward the potential significance of any typology of morphological systems, the search for such a typology has an important role to play; and indeed, when put into proper perspective, it constitutes another way of posing the most fundamental questions there are about word structure. This is because, beside the search for overall correlations among phenomena that might yield a minimal specification of the range of languages in the world, there is another methodology available for pursuing typological studies. This is to attempt to ensure that whatever the account that is given of some area of linguistic structure (morphology, for instance), it is one that will be adequate to accommodate all of the systems that might be encountered. One can do 'typology,' that is, in the sense of exploring the full range of diversity in the languages of the world, without necessarily feeling that the effort has been a failure if that diversity is not ultimately reducible to some small number of binary- or ternary-valued parameters.

This is actually a perfectly respectable goal to take along in exploring the typology of morphological systems (among other parts of language), even though it is not what most people think of as the goal of typology. But now notice that on this reading, the development of a genuinely adequate typology is a project which is essentially co-extensive with the development of a generally applicable morphological theory. A theoretical descriptive framework which is really adequate to all of the world's languages can be seen as constituting in itself the most central kind of a 'typology,' even if its descriptive dimensions
do not reduce to some small number of parametric possibilities. Of course, where correlations are to be found, they ought properly to be incorporated into the theory; and if enough are found, maybe it will be possible once again to interpret the theory as a set of labels for language types. But this is only one of many possible outcomes, and in the meantime there seems no particularly good reason to distinguish fundamentally between linguistic typology and linguistic theory, construed as a general enterprise.

12.2 Sapir's typology of word structure

Let us, then, turn to the most fully developed notion of word-structure typology in the traditional literature, taking this to be (at least the outline of) a theory of the range of constructs that are necessary in principle for the description of the morphological systems of all possible languages. As suggested at the outset of this chapter, the system outlined in Sapir's *Language* (1921) goes as far as anything in this direction, and it is that framework that will be examined briefly here.

Following a tradition represented also by his teacher Franz Boas, Sapir starts from the notion that the word-structure system of a language is composed of two kinds of object and their inter-relations: a set of grammatical processes and a set of concepts expressed by the application of those processes. There must also be, of course, a basic word stock that serves as the foundation for morphological elaboration. Now the important thing about these two sets is the fact that they are in principle quite independent of one another:

> The question of form in language presents itself under two aspects. We may either consider the formal methods employed by a language, its "grammatical processes," or we may ascertain the distribution of concepts with reference to formal expression. What are the formal patterns of the language? And what types of concepts make up the content of these formal patterns? The two points of view are quite distinct. (Sapir 1921: 57)

The independence of the two sorts of object means that the relation between processes and concepts is (at least in the general case) many-to-many, with the same process associated with multiple concepts and/or the same concept expressed by more than one process. For example, in English the single process 'suffix /z/' (more formally, /X/ → /Xz/) may be invoked to express plurality, third-person singular present in Verbs, possessive, etc.; while the same concept, for example, 'plural' may be expressed in a number of different ways ('suffix /z/,' 'umlaut stem /au/ to /ai/,' /Xum/ → /Xa/, etc.). This is the notion of morphological structure which has also been adopted in the present work, as
well as in the recent literature in one form or another by a number of other authors. As has repeatedly been stressed in previous chapters, it differs in quite fundamental ways from views based on the traditional conception of the 'morpheme,' an exaggeratedly minimal Saussurean sign composed of the unity of a constituent of form with a constituent of meaning. As opposed to the one-to-one relation between elements of form and of content that ought to obtain if words were really composed exhaustively of such 'morphemes,' the picture presented by Sapir (and his successors in the current literature) predicts the rather more complex state that seems actually to characterize much of natural language (and of which, of course, the simple one-to-one association is simply a special, limiting case). Reasons to believe in such a position have been developed elsewhere in this book; the present remarks are intended only to point out that this was also Sapir's view.

With respect to the typology of morphological systems, Sapir proposed to replace the traditional one-dimensional classifications (such as that into isolating, agglutinating, inflecting, etc. languages) with a number of logically independent classificatory parameters. Given his view that morphology is made up of a set of processes and a set of concepts, it is quite natural that the basic division within this scheme is between one dimension relating to the type(s) of processes a language employs and another referring to the sorts of concepts it expresses morphologically. A third dimension, referring to the degree of internal complexity of words, corresponds to the traditional scale that runs from 'isolating' to 'polysynthetic.' Sapir actually has little to say about this last dimension (which for him runs from 'analytic' languages through 'synthetic' to 'polysynthetic' ones), and since it is less obvious how it might correspond to a distinct aspect of the grammar, it will be ignored here. Our present focus is on Sapir's typologies of processes and of concepts, and on the presuppositions about morphological structure which appear to underlie them.

The types of process that Sapir recognizes can be described in comparatively brief terms, since the inventory he gives is a rather familiar one. He notes that concepts can be expressed by any of the following techniques:

(1)  a. Word order  
b. Composition (compounding of stems)  
c. Affixation (including prefixation, suffixation, and infixation)  
d. Internal modification (vocalic or consonantal Ablaut, consonant mutation, etc.)  
e. Reduplication  
f. Variations in accent (pitch, stress etc.)

This catalog of possibilities is not a particularly revolutionary one, and in fact the main point to note about it is the fact that affixation is treated as just one kind of process, on a par with other changes of a non-affixal character.
Morpheme-based views of morphology, in contrast, tend to consider affixes as the only really legitimate kind of morpheme, with everything else described as some sort of morphologically conditioned phonological concomitant of a (possibly null) affix.

A contemporary account of the formal processes that play a role in morphological structure would look quite like Sapir's, though the distinct status of some of his types within morphological theory can perhaps be questioned: we might well omit "word order" for instance, since that is not really an aspect of morphology. Reduplication can perhaps be subsumed at least partly under the heading of affixation, following the now familiar line of McCarthy 1981, Marantz 1982, and others. The category of variation in accent probably involves some instances of affixation and some of internal modification; in Sapir's day, accentual phenomena (especially pitch) were treated as somewhat more exotic and less connected with the segmental phonology than would be acceptable today.

On the other hand, we might well add to Sapir's list from other possibilities discussed in chapter 3 above. Such additions would include the possibility of circumfixes (simultaneous prefixation and suffixation corresponding to a single unit of morphological form), as well as various non-affixational possibilities, such as metathesis or reordering of segments, and the marking of a grammatical category not by the presence of some overt formative but rather by the (anti-iconic: see Dressler 1985, 1987) deletion of phonological material from the base. Such a process would have been called a 'subtractive morph' in Hockett's (1947) guide to the structuralist morphological zoo; what is important for present purposes is that it has no apparent (coherent) reformulation as the addition of an affix.

With the modifications suggested above, then, a list like Sapir's can serve

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1 As pointed out in chapter 3 above, however, it is not actually obvious that the affixation analysis solves all of the problems involved in reduplication. In particular, the actual mechanics of association of melodic material with the empty skeletal positions analyzed as an affix of reduplication are not always straightforward or, apparently, general. It remains to be seen whether all instances of apparent reduplication can be successfully reduced to the simple addition of an affix which happens to be melodically underspecified, as originally suggested by McCarthy and Marantz.

2 Naturally, we would like to go beyond listing to provide a more explanatory account of the class of grammatical processes. Along with the apparent seductiveness of the classical morpheme, this seems to be some of what lies behind attempts to reduce all of morphology to affixation. As we have argued elsewhere in this book, it does not seem possible to accomplish that reduction, unfortunately; but the alternative of saying simply that the class of grammatical processes is delimited by the possibilities of a rich transformational formalism is unsatisfactory as well. One possibility, suggested by Martin (1988), is the claim that the operations available to morphology are exactly those available to the phonology, thus reducing one unsolved problem to another. A complicating factor is the role of historical change in shaping synchronic morphologies: this may have the consequence that actually attested systems contain an unrepresentative (or at least seriously skewed) selection from among the theoretically possible processes. For some discussion of this, see chapter 13 below and Janda 1984.
as a description of the grammatical processes available to individual languages. Each particular word-formational process invokes one of them (or perhaps more than one at a time, as in the case of German suffixes accompanied by stem Umlaut). As the basis of a typology, such a list can be used to characterize the subset of what is formally possible that is actually instantiated in a particular system. Where a language has no complex words at all, of course, it requires no word-formation processes, and this can be regarded as the limiting case which is identified by the term *isolating*. Where all of the rules involve affixation, pure and simple, with no other changes, this is the defining characteristic of an **agglutinating** language. If at least some of the Word Formation Rules of a language involve non-affixational processes (internal change, metathesis, subtraction, accent shift, etc.), this is the basis for calling the morphology of that language **symbolic** (to use Sapir's term).

Finally, the phenomenon that was classically supposed to make Indo-European languages of the ancient type so special was the presence of complex affixation: affixes that are accompanied by some morphologically motivated phonological change. Languages with such internally complex processes are called **inflecting** in an earlier terminology, one that seems sufficiently misleading to require replacement, as for instance by Sapir's term **fusional**. The defining characteristic of this type is primarily the fact that segmentation into neat, discrete morphemes is rendered more difficult by the extent to which other effects accompany or obscure affixation. The over-valuation of this supposed linguistic 'type' seems to be an instance of making a virtue of necessity, and there is no particular reason to recognize it as distinct. Of course, the degree of internal complexity of those word formation rules that cumulate two or more processes as a unitary indication of some category is evidently a possible dimension of the formal structure of a morphological system.

This gives us a set of categories (isolating, agglutinating, symbolic, and fusional) that can be laid out (somewhat uncomfortably) on a sort of scale. But does this serve as a 'typology' for language? It would, if languages were homogeneous, such that for instance the presence of a single 'symbolic' process entailed the exclusivity of this formal type of Word Formation Rule. But as everyone knows, that is not the way the facts actually do turn out. Of course a single rule in a single language does have a particular type within this scheme, but languages as wholes tend to involve greater or lesser mixtures of different sorts of processes.

In the rare case where *all* of a language's morphology is limited to a single formal type, as for instance where Turkish is commonly claimed to be limited to suffixation, we can call such a language, for example, 'agglutinating' as a whole. Most languages will not be eligible for such comprehensive labels,
However. In general, it is individual rules and not entire languages that can meaningfully be called agglutinating, symbolic, or fusional in any precise, categorial sense.

There are clearly generalizations to be made over the sets of word-formation processes that constitute the morphological systems of (entire) languages, but these are only very rarely of the sort captured by labels like 'agglutinating,' etc. Much more common is the highly local sort of generalization typified by the fact that English inflection is based entirely on the rules 'suffix /z/' and 'suffix /d/.' In a given language there are typically some rather specific, language-particular statements to be made about the range of its grammatical processes, perhaps in the form of some sort of redundancy rule over morphological rules or 'meta-rule' as has occasionally been suggested. The rule classes identified in such generalizations, however, tend both to be much more specific than those delimited in (1) and also to involve overlap among the classical formal types. Indeed, it is questionable whether a label like 'agglutinating' actually captures a significant reality in the cases where it can be consistently applied: surely it is at least as important that all of the morphological material of Turkish is borne by suffixes as that the rules are all ones of affixation.

If these observations are correct, there is no reason to expect any (suitably modified) version of the rule typology in (1) to serve as the basis of a typology for languages, as implied by the traditional labels. This is confirmed by the fact that when Sapir, who attempts to use such labels as one dimension of his typology, actually gets around to classifying languages on the basis of their morphological 'technique,' the values he assigns tend to be expressions like 'fusional-agglutinative, with a symbolic tinge.' Such a formulation may reflect well the overall statistical balance of different process types in a language, but it is not at all the sort of categorial description we expect of a typology, and its actual significance is far from clear. We conclude that it is important to study the range of grammatical processes found in the languages of the world, so as to understand how morphological rules operate; but that this effort is unlikely to pay dividends of the sort imagined by classical typologies.

Passing from the study of process types to that of concepts, we reach what can be argued to be the most interesting and innovative part of the discussion. Sapir notes first of all that there is a range of concepts which can be formally expressed in language, and suggests that these fall into a small number of categories, as in (2):

3 The notion of 'meta-rules' over the morphology was suggested in Anderson 1986a. Janda (1982 and elsewhere) has explored in some detail the notion that individual languages make extensive use of a small number of processes.
For a fuller discussion of just how these are delineated by Sapir, the reader must of course consult the original text, but the essential content of the categories in (2) is as follows. The ‘basic’ concepts of (2a) are those involved in the fundamental semantics of basic lexical roots, which characterize the meanings of the language’s elementary word stock (e.g., the properties representing the basic meaning of “cat”). The “derivational” concepts of (2b), in contrast, are those introduced by a set of semantic functions which operate on lexical items to yield new lexical stems from existing ones (for example, the semantic correlate of the diminutive process which maps German Katze “cat” into Kätzchen “kitten”). The ‘pure relational’ concepts of (2d) are a set of intrinsically a-semantic features having purely grammatical significance, but nonetheless formally represented in the shapes of individual words as a reflection of syntactic structure (e.g. the role of the nominative case in Latin to mark the Subject); while the ‘mixed’ or ‘concrete relational’ concepts of (2c) are those that function syntactically, like the pure relational concepts, but which can be projected in some position from the semantics of some part of the structure (e.g. grammatical number in English, which is grammatically relevant as the basis of the agreement relation between Subjects and Verbs, but which is a function of the semantics of the Subject NP).

Sapir then observes that the members of these categories are not all equally necessary to the structure of language in general. In order to say anything at all, of course, the speaker of a language must have at hand some meaningful words, and so every language must express ‘basic’ or ‘radical’ concepts. Furthermore, these words must be capable of being put together syntactically, and the representation of syntactic structure is the business of the ‘relational’ concepts: indicating Subject-hood and Object-hood, status as modifier vs. modified, etc. Much of the structure indicated by pure relational concepts may be reflected by word order alone, and so is of no particular interest to a theory of word structure. Recall, however, that Sapir himself includes word order as a ‘grammatical process’: in consequence, he can claim that every language must of necessity have some formal expression of his pure relational concepts, since otherwise it would have no syntactic structure. Abstracting away from word order, then, we can see that ‘pure relational’ concepts will be represented morphologically exactly where information of a purely syntactic nature is carried by the forms of words.

As opposed to ‘basic’ and ‘pure relational’ notions, however, which must necessarily be formally represented in some fashion in every language, there
is no necessity for a language to have any 'derivational' concepts at all. It is always possible to represent a complex meaning as a (syntactically formed) combination of two or more basic meanings, like "little tree," instead of as a derivational function modifying a single basic meaning (as in "tree-let"). Similarly, it is not necessary for a language to make use of any semantically significant property, like number or (natural) gender, as one of the devices that indicate grammatical structure such as the modifier-modified relation or that between a predicate and its subject. Mixed relational concepts as a category are thus dispensable to particular languages as well.

Sapir thus suggests that we can classify languages according to what elaborations of the basic, irreducible inventory of concept types ('basic' and 'pure relational') they employ. That is, a language may optionally make use of derivational concepts; mixed relational concepts; both of these; or neither. It might seem that the resulting four classes of language would provide a rather clear-cut categorial distinction, and that any given language would belong to exactly one of the four set types; but in fact when Sapir actually applies this classification in concrete cases, it too turns out to be somewhat more of a scale than might be expected. Languages turn out to develop, say, derivational concepts to a greater or a lesser degree. Again, it seems more useful to think of a particular rule as 'realizing' or 'implementing' a concept of a particular type, rather than of a whole language as doing this.

What is particularly interesting about this schema, and what is relevant to current morphological discussion, is the framework within which the distinction between relational and non-relational concepts is introduced. Limitations of space preclude a detailed rehearsal of Sapir's analysis here, but its essence is an argument that the grammatical pattern of a sentence is to be described in a way that is completely independent of the degree of morphological complexity (indeed, of the morphological or semantic content) of the words that actually compose it. This is suggested fairly well by the following quotation from Language. After comparing the two sentences *The farmer kills the duckling* and *The man takes the chick*, he goes on to observe that

we feel instinctively, without the slightest attempt at conscious analysis, that the two sentences fit precisely the same pattern, that they are really the same fundamental sentence, differing only in their material trappings. In other words, they express identical relational concepts in an identical manner. (Sapir 1921: 85)

We can interpret this, only a little bit anachronistically, as a sort of incipient statement of the Lexicalist Hypothesis: the claim that the syntax neither manipulates nor has access to the internal structure of words. Rather, it derives a grammatical pattern in which constituency, word order, and the
distribution of 'relational' concepts are specified – in contemporary terms, an S-structure with no concrete lexical items contained in it. These actual lexical items come from the word stock of the language, which is made up of its basic words together with the results of applying to these any derivational functions the language may employ (and insofar as the rules of the language permit, further derivations from derived stems).

Since derivational concepts are integral parts of the lexical items that constitute the "material trappings" of sentences, they clearly must be introduced within whatever we want to call the dictionary or word stock of a language. Relational concepts, on the other hand, are part of the grammatical pattern: in fact, it is precisely the property of being part of the grammatical pattern that makes a concept 'relational' in the first place. This is true regardless of whether a given relational concept is 'pure' (i.e., exclusively of syntactic import) or 'mixed' (i.e., related to semantic as well as syntactic properties). We must imagine that the mixed relational concepts are indicated in grammatical structure, and serve to constrain the implementation of that structure in concrete words by requiring that only items whose semantics is consistent with the features present may interpret the relevant positions in the structure.

The Janus-like property of mixed relational concepts, which have both a syntactic and a semantic side, leads to the rather interesting consequence that it is not possible to determine the role a given concept plays in the grammar just by knowing its signification. The same concept (in terms of signification alone), that is, may either be relational or not depending on whether it has a role to play in the grammar as well as a meaning.

Consider the property 'plural,' for instance, whose signification we can agree is clear and more or less identifiable across languages. Sapir compares the role of the 'plural' in English with its role in Nootka in a form like that below:

(3) inikw-ihl-minih-pis-pi
    fire-in house-PL-DIM-DEF
    "the small fires in the house"

* Actually, this is already clear from the fact that the same sense can be conveyed either by a basic concept associated with a root or by a derivational function. Since both basic and derivational concepts are localized within the dictionary, however, the indeterminacy involved here is less radical than the point referred to in the text.

* Although this ethnonym has a securely established status in the linguistic literature, it is actually not an accurate name for the people Sapir referred to (more accurately known as the Tsishaath or Tseshaht [c'isa-Path]) or for their language. Since we are not fundamentally concerned here with the ethnography of the northwest coast of North America, however, we will perpetuate Sapir's usage here in the spirit of quotation.
Sapir’s typology of word structure

Sapir argues that in Nootka the plural is a derivational category, as opposed to English, where it is a (mixed) relational one. There are two parts to this argument: “First, the plural element precedes the diminutive in Nootka” (Sapir 1921: 105). Now this is only an argument if we assume that concepts of the relational sort form layers of structure that are strictly external to any layers formed by derivational concepts. On the (unchallenged) assumption that the diminutive in Nootka is in fact derivational, this entails a similar derivational status for any concept represented by a structural layer internal to that of the diminutive. Since Sapir’s relational concepts are just the ones that correspond to inflectional morphology (as opposed to derivation) in traditional and current writing, the argument thus rests on the traditional observation that inflection comes ‘outside of’ derivation – an observation made more precise and demonstrated to be a theorem in the morphological system developed in this work, especially chapter 5 where the relevant principle is formulated as (12).

This argument would only be of interest if we could find some independent confirmation of the claim that only the English plural, and not that of Nootka, actually meets the criteria for being a relational category. This is in fact provided as the second step in Sapir’s argument:

What more than anything else cuts off all possibility of comparison between [the plural in English and in Nootka] is this, that in Nootka neither the plural nor the diminutive affix corresponds or refers to anything else in the sentence. In English “the house-firelets burn” (not “burns”), in Nootka neither verb, nor adjective, nor anything else in the proposition is the least concerned with the plurality or the diminutiveness of the fire. (Sapir 1921: 105)

That is, neither ‘plural’ nor ‘diminutive’ is distributed by a rule of grammatical patterning in Nootka. In English, ‘plural’ is a mixed relational notion, while in Nootka it is a derivational one, not because the category involved means different things in the two languages but rather because English has a syntactic rule of agreement that makes reference to it while Nootka has no such rule. Because of this difference, it is perfectly coherent for the Nootka plural marker to come inside of other clearly derivational material, while this would not be possible in English.

The defining property of relational concepts is given rather discursively by Sapir, but this argument (in the context of the rather extensive discussion in chapter 5 of Language) makes it clear that what is meant is the following:

(4) Relational concepts are those that are relevant to the grammatical structure of the sentence, independent of its lexical interpretation.
12.3 Conclusion

Let us now sum up Sapir's framework for morphological typology and grammatical description, which has several interesting properties. Formally, the morphology of a language consists of an inventory of processes that can affect the shapes of words so as to express concepts. In particular, morphology does not consist of a collection of form/meaning pairs (minimal signs) that can be concatenated to form words, as on later models taking the morpheme as a primitive notion. Furthermore, the 'syntax' (or the 'grammar') is a system that describes abstract, neutral grammatical structures without regard to the specific words which will interpret the structural positions within them. The dictionary of a language contains its basic word stock, together with the results of any derivational processes it may utilize. Such derivational processes (better, grammatical processes expressing derivational concepts) apply 'in the dictionary' in this sense. In contrast, inflectional grammatical processes (i.e. those distributing and expressing relational concepts) must apply 'in the syntax,' in the sense that they must apply to a lexically interpreted grammatical structure. Despite this difference in their interaction with the rest of the grammar, a single set of generalizations may characterize the set of 'grammatical processes' (or morphological rules) of a language, whether derivational or inflectional.

This framework should seem fairly familiar to readers who have persevered to this point in the present work, since it is essentially identical with the point of view defended in previous chapters. Naturally, this result will seem a felicitous one for an adherent of this view, since there are many scholars who it would be a lot worse to have on one's side in a difference of intellectual opinion than Sapir. However, the main point here is the slightly more modest one that such a view of the matter seemed for Sapir to flow rather naturally out of an attempt to explore the limits of the diversity to be found in the word-structure systems of natural languages. He himself said he was talking about the "types of Linguistic Structure" in the culminating chapter of his discussion of morphological theory. It is fairly clear that when typological investigation is carried out in a genuinely universalizing way, it is not really distinct from the development of a general theory of morphological structure. In other words, responsible typology is no different from 'doing theory'.

As a matter more of the sociology of the field than of its substance, people who say they are doing 'typology' often are more concerned with catalogs of surface phenomena than with explanatory frameworks, and they have a bias toward descriptions that put everything into a small number of discrete categories; while people who say they are doing 'theory' often do most of it
on the basis of finding out more and more about a very few languages. Everyone knows that there are more than enough both of abuses and of exceptions on each side, but the goal of the present chapter has been to show that the dichotomy is a fundamentally illusory one, since there is no substantial difference between typology and theory when correctly viewed. Of course, if it turns out that the correct descriptive framework admits of only a very few dimensions of variation for languages, with few possible values on each, some will say that we have discovered a typological framework while others will say that we have found the right set of parameters for Universal Grammar. There is no reason to think that what would make the one set happy should not make the others happy too, though. And seeing the typological and the theoretical enterprise as basically the same should provide a worthwhile insight for all concerned.
13 Morphological change

Only a few years ago, Lightfoot (1979) could correctly note that most of what passes for the study of syntactic change in the literature of linguistics is really concerned with change in morphological rather than syntactic properties. As the opposite side of the same coin, much of the literature on phonological change is similarly devoted to essentially morphological problems. This state of affairs doubtless derives today from the early generative program of reducing word structure either to syntax or to phonology, but in any case, the revival of synchronic morphology as a viable object of enquiry calls for corresponding study of the nature of change in morphological systems.

The present chapter discusses some basic issues of change in morphological systems, in the context of the theory developed in this book. We begin with a short excursus on the role of the study of change in the development of a synchronic theory of word structure, arguing that an adequate theory of what structures are possible in natural languages probably cannot be provided on a purely synchronic basis. Rather, we must view "what there is" as the product of "what is possible" with the range of possible diachronic developments. Linguistic structures do not simply spring into existence ex nihilo: most linguistic forms and regularities are inherited either directly or through the lens of linguistic change from previous states of the language; or else borrowed from the systems of other languages. Given this, we cannot necessarily understand the human language faculty simply by studying the content of attested natural languages. Phenomena that a descriptively (as opposed to observationally) adequate theory of that faculty ought to accommodate might well happen never to be attested, either by accident or because there is no course of change or borrowing by which they could arise. An understanding of the mechanisms of change and borrowing is therefore important because it sets potential limits on the extent to which we can draw theoretical conclusions from observed limitations on the content of linguistic systems. Such a comprehensive theory of change is well beyond the scope of the present chapter, of course: we wish only to call attention to the basic mechanisms of change which must be understood if one is to be provided.

The conventional division of morphological structure into questions of
13.1 Morphological change and synchronic morphology

The diachronic development of morphological systems is interesting for its own sake, of course, but it also merits attention even on the part of those concerned with a synchronic view of word structure. It is by now a familiar result from the study of change in phonology and in syntax that our understanding of the internal dynamics of linguistic systems is often enhanced by a study of the paths along which they change. Like an animal standing against the background of a forest, the outlines of a grammar can be thrown into sudden relief when something changes. An understanding of change in the word-formation principles of language can serve this function. It has another potential role as well, assisting in the development of a genuinely explanatory theory of synchronic morphology.

Contemporary linguists are concerned (probably as never before) to find theories of linguistic structure that are not only adequate to the description of all possible human languages, but sufficiently constrained to provide an interesting and substantive understanding of just what systems are possible. On the other hand, recent developments (especially in the study of syntax) make it clear that explanatory theories of a particular domain are often to be derived not solely from the properties of that domain in itself, but also...
from the way its facts and principles interact with the content of other domains. Allowing one part of the grammar to 'overgenerate' in the context of constraints imposed by its interaction with other areas often makes it possible to bring order and coherence to each independently – order and coherence that would be impossible if the principles determining the range of possible phenomena in each part of the grammar had to be limited to statements internal to that domain alone. Such a modular conception of grammar thus seems in many cases the only path to a constrained account.

In the study of morphology, we can apply this insight to a fundamental question: what formal realizations can morphological categories have? An adequate theory should limit the class of morphological operations to those actually possible in natural languages; and one widely advocated program for attaining this goal claims that all morphology can be described as affixation. If true, this would be a very substantial result, but in previous chapters, we have seen reasons to believe that some morphological categories in some languages are expressed by replacements ('Ablaut'), deletion, metathesis, and other non-affixal operations on word form. If this conclusion entailed the full power of "the extremely rich transformational notation" (McCarthy 1981: 373), we would be left with no principled account, reducible to some common underlying principle, of why only a rather limited subset of possibilities are in fact attested.

As we observed in chapter 3, many of the sorts of permutations, deletions, counting operations, etc. which every morphologist feels the theory ought to prohibit actually arise in the rules of secret languages or language games. Language-game evidence\(^1\) is quite generally appealed to in phonological and morphological discussion, for the reason that it often illustrates phonological circumstances that do not arise under 'normal' conditions. The rules of such systems can evidently be embedded into the morphological and phonological system of a language; and since this occurs in a wide range of literate and non-literate linguistic communities alike, it is not possible simply to write it off as an artificial, secondary phenomenon. But if the range of possible Word Formation Rules must accommodate those illustrated by language games, it is clear that any set of constraints on morphological processes that stop much short of a 'transformational' formalism are bound to fail.

Faced with a conflict between the apparent observational inadequacy of a purely affixational theory of morphology and the apparent over-richness of an unconstrained transformational theory, the possibility arises that the solution to the problem of accounting for what is found in the morphology of natural languages does not lie entirely within the synchronic theory of

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\(^1\) See Bagemihl 1988 for a comprehensive survey of the literature in this and related areas.
The morphologization of phonological rules

13.2 The morphologization of phonological rules

Turning to the ways in which the contents of a language's morphological system can arise historically, we begin with the principles governing the appearance of the 'same' morphological element in phonologically distinct forms in different words. These can be divided into several types. Sometimes the factors influencing the choice of one variant over another are purely phonological (as in the variants of the English regular plural ending); sometimes they depend on the identity of specific neighbouring formatives (as when the final segment of evade is devoiced before -ive in evasive); and

2 Consider the evolution of Umlaut in Germanic languages, for example, from an original low-level assimilation of vowel quality to a phonologized change of vocalic identity, at one point a predictable concomitant of certain suffix vowels but later a morphologized effect which serves in some cases as the sole marker of a category (e.g., German Vater “father”, pl. Väter).
sometimes they are matters of arbitrary lexical suppletion (as in the case of *were* as the past form of *was*). It is hardly a novel suggestion that most if not all cases of morphologically or lexically determined variation can be traced historically to the effects of originally phonological rules.\(^3\) The reanalysis of phonological rules as morphologically determined results, on the assumptions of previous chapters, in their incorporation into the morphology, and is thus a fundamental kind of change affecting that part of grammar. In discussing such changes, we need to clarify two aspects: the mechanisms and motivations underlying the change itself, and its consequences for the properties of the rule.

### 13.2.1 The mechanism of morphologization

Over a hundred years ago, the Polish linguists Jan Baudouin de Courtenay and Mikolaj Kruszewski (Anderson 1985b: ch. 3) hypothesized that phonological alternation has its origins in low-level, largely mechanical 'anthropophonic' (or as we would say today, purely phonetic) variations. These variations may at some point assume sufficient prominence for speakers that they are interpreted as being governed by the system of the language rather than by the exigencies of articulation and acoustics, and as a result they become phonological rules. Subsequently, new phonological rules arise within the same language which obscure the effects of existing rules, and the extent to which the earlier ones remain phonetically motivated generalizations about the structure of surface forms declines. The earlier rules thereby become increasingly opaque, in the sense of Kiparsky 1973b and elsewhere. As new generations of speakers confront the task of learning the language, they continue to look for phonological bases for variation, but increasing opacity may obscure this sufficiently that a set of morphological conditions is more accessible. At this point, while the change effected by the rule may remain the same, it is now interpreted as conditioned by some fact(s) about morphological categories rather than by the phonological configurations in which it occurs. Morphologization of the rule has taken place.

On this view, the study of the process of morphologization is largely concerned with the development of opacity in phonological rules. The literature on this topic is considerable, and considerations of space preclude a serious review of it here. Several instructive examples are discussed in Wurzel

\(^3\) Among the exceptions to the claim that morphological variation has diachronic phonological origins are (a) instances in which analogical reformation internal to the morphology has resulted in variation; and (b) instances in which the paradigms of two or more originally distinct forms have been blended into a single internally suppletive paradigm. It is at least worth exploring the possibility that the range of such exceptions can be narrowly limited, and the individual possibilities studied substantively enough to avoid evacuating the explanatory value which the theory of morphological change has for an understanding of the nature of synchronic systems.
1980 specifically in connection with the conditions of morphologization; we summarize one of those examples here.

One of the nominal declensions of proto-Germanic was the class of s-stems, which displayed a paradigm like that of (1).

(1) | Singular | Plural |
---|---|---|
Nom. | lambiz | lambizô |
Gen. | lambizaza | lambizom |
Dat. | lambizai | lambizomoz |
Acc. | lambiz | lambizô |

In this paradigm, /iz/ appears as an extension of stems like /lamb(iz)/, present in the lexical entry of these Nouns as a characteristic of their membership in the set of 's-stems.'

A number of phonological affected these forms. Final /z/ was lost after unstressed syllables, affecting the Nominative and Accusative singular forms in (1). Later, final short /i/ was lost after heavy syllables (i.e., those containing a long vowel or ending in a cluster). Other changes yield the paradigm in (2) for the pre-Old High German period.

(2) | Singular | Plural |
---|---|---|
Nom. | lamb | lambiru |
Gen. | lambiras | lambiro |
Dat. | lambira | lambirum |
Ac. | lamb | lambiru |

In (2), the stem formant (now /ir/) only appears in some of the surface forms of the of the paradigm, due to the operation of phonological rules. Among these is the rule dropping final short /i/, which is rendered opaque by a subsequent process that shortens final long /i/ to yield, for example, *gasti from earlier *gastî. The rule dropping final short /i/ also generalized to apply after light syllables as well as heavy syllables, which made it seriously opaque, since short /i/s were thus lost in so many places as to be difficult to recover. Many of the forms originally involving such loss were simply reanalyzed with no underlying /i/. The /i/-loss rule is still involved in the paradigm of (2), but it applies in the same set of cases as the rule deleting final /z/ (now /r/). As a result, the motivation for separating the two rules disappears, and they are replaced by the single rule in (3).

(3) \( ir \rightarrow \emptyset /VC_0\)
Morphological change

basis, and renders it applicable only to a limited set of specific morphological elements.

Further changes affecting the forms of interest here involved the loss of final short /u/ and the reduction of certain unstressed vowels to schwa (usually written e). This resulted in the early Old High German forms in (4).

(4)          Singular        Plural
            Nom.    lamb      lambir
            Gen.    lambires  lambiro
            Dat.    lambire   lambirum
            Acc.    lamb      lambir

In this paradigm, application of rule (3) is no longer transparent, since final /ir/ now appears in the Nominative and Accusative plural (where it was formerly protected from loss by the /u/s that have now disappeared from the surface form). Since there is no longer an evident phonological generalization to appeal to, it is simpler to state the generalization as a morphological one describing where /ir/ appears, as in (5).

(5) /X/ → /Xir/ / + Plural
        { + Genitive
          + Dative
        } (in certain Nouns)

The replacement of a rule like (3) by one like (5), which performs the inverse change in a set of environments that are effectively the complement of those of the first rule, is called 'rule inversion' (Vennemann 1972), a process which contributes to the opacity of a (phonological) rule by making its change phonologically more arbitrary. In the present case, the inversion accompanies a reanalysis of the rule's environment as morphological. The morphologization of the rule at this stage is confirmed by its subsequent evolution: the complex disjunction in (5) is simplified to insert /ir/ only in plurals, yielding the Old High German paradigm in (6).

(6)          Singular        Plural
            Nom.    lamb      lembir
            Gen.    lambes    lembiro
            Dat.    lambe     lembirum
            Acc.    lamb      lembir

The loss of /ir/ from the Genitive and Dative singular forms has no purely phonological explanation, but constitutes a simplification on the view that the rules affecting this formative have been morphologized.

* The appearance of umlauted e from a in the plural forms in (6) is an additional innovation at this point which is irrelevant to the matters under discussion here.
The general mechanisms illustrated here include rule telescoping and inversion, and the development of opacity in phonological processes through their interaction with other rules. All of these make an originally phonological condition more arbitrary and difficult for the learner to discover, and thus increase the appeal of a morphologically based rule. As such, they contribute to the morphologization of rules in numerous cases.

Accepting morphologization as a type of change, we can ask whether such changes are always categorial and complete or whether they are sometimes only partial. There are two senses in which morphologization might be partial: it might simply involve the addition of some morphological conditions to the rule, resulting in a 'morphologically conditioned phonological rule'; or it might involve the division of the rule into two (or more) separate processes, some affecting morphologically characterized environment and some remaining purely phonological. We have implicitly rejected the first possibility in previous chapters, by denying the existence of a class of 'morphologically conditioned phonological rules'; we discuss this matter further in the following section. There is, however, good reason to believe that a phonological environment for a given change may persist even after some instances of the rule's application have been reanalyzed as morphologically determined.

The rule of u-umlaut in Icelandic, for example, was originally purely phonological in character as formulated in (7).\(^5\)

\[(7) \quad a \rightarrow o / -C_o \ u\]

This rule still applies in Modern Icelandic in all instances where its phonological environment would be satisfied, except for forms in which the u which might trigger it is itself epenthetic (see Anderson 1974b; Kiparsky 1984).

A number of u's which originally triggered the rule were lost, in categories where their original presence is subsequently indicated only by the occurrence of unumlauted stem vowels. Since there is no other evidence for these original us, they have been eliminated, and their effects produced by a new umlaut rule effecting the same change as that in (7) in specific morphological categories: the Nominative and Accusative plural of strong neuter Nouns (e.g. barn “child,” pl. börn) and Adjectives, and all cases of singular feminine strong Nouns except the genitive (e.g. öxl “shoulder,” gen. axlar, pl. axlir), among others.

\(^5\) This rule originally had the effect of rounding the vowel a to a vowel conventionally written o in Old Icelandic texts when a u followed in the next syllable. The product of this change corresponds to the vowel ð in modern Icelandic. Note also that the product of u-umlaut in unstressed syllables undergoes a rule of Vowel Reduction to become u – which can in its turn cause the umlaut of a preceding syllable.
The fact that these cases of umlaut have been morphologized is indicated by the fact that the umlauted vowel has spread into the Genitives of some strong feminine Nouns (e.g. *verzlun* “shop,” gen. *verzlunar*, pl. *verzlanir*), where the ending -ar precludes phonological conditioning of (7). We can also note that a very few masculine Nouns, whose singular endings are normally inconsistent with the operation of (7), also show the effects of a morphologized umlaut rule (e.g. *söfnudur* “congregation,” gen. *safnadur*, dat. *söfnudí*, acc. *söfnudð*). These are exactly the masculine Nouns that might be expected to show a morphologically based similarity to the feminine paradigms, since they all take the (normally feminine) genitive ending -ar instead of the usual masculine genitive ending -s.

Modern Icelandic thus has two distinct kinds of u-umlaut: purely phonological instances, governed by rule (7), and morphologized ones governed by rules not based on phonological form. The process of morphologization has affected only those cases in which the degree of opacity of a phonological solution was too great: i.e., where the conditioning desinential -u could never surface, and thus was lost. Among the remaining cases, some phonological environments make (7) partially opaque (since it must apply before the insertion of epenthetic /u/ in forms like *hattur* “hat” from underlying /hattr/), but not sufficiently so to provoke a more widespread morphologization.

Phonological rules are morphologized when other aspects of the grammar render them sufficiently opaque, or when they lose their basis as generalizations about phonological structure and come to describe the behavior of a few specific morphological elements instead. In this case, a morphological formulation of the conditions for an alternation is evidently highly accessible in language acquisition. Phonological rules can remain phonological even in the face of some limited amounts of opacity, however; and even when morphological conditions come to determine some applications of a rule, a parallel phonologically based generalization may remain part of the grammar.

### 13.2.2 The consequences of morphologization

When a phonological environment for a rule is replaced by a morphological one, this might have other consequences as well. In particular, insofar as we can establish differences in the formal properties of phonological and morphological rules, we might expect that a rule whose status changes would also change with respect to whatever relevant properties it displays. In fact, there is reason to believe that this prediction is correct: we noted earlier, in chapter 2, that in the case of rules such as Southern Bantu palatalization and Maltese vowel harmony, a shift of status from purely phonological to morphological conditioning appears to bring about a concomitant shift in
13.2 The morphologization of phonological rules

the relevant conditions of 'adjacency' operative in constraining the rule's applicability.

Let us now return to the question, raised above, of whether it is possible for the morphologization of a rule to be 'partial' in the sense of consisting simply of adding morphological conditions to a phonological rule. The implicit answer provided by most of the phonological literature, which makes generous use of "morphologically conditioned phonological rules," is that such a change is possible. We have claimed, in contrast, that rules must be categorically either phonological or morphological. If that is correct, what consequences should we expect to follow? On the picture of morphology sketched in preceding chapters, morphological (or Word Formation) rules specify unitary (if complex) structural changes that determine the formal reflections of morphological categories. Thus, if the same formal marker is found in several distinct categories, it is on this view introduced by distinct Word Formation Rules. Consequently, if a change were morphologized so as to apply in a number of distinct morphological categories instead of in a unitary phonological environment, this would result in its formal fragmentation into a number of distinct rules, insofar as there is no single property that unifies the categories involved.

We might then expect that the fragmented morphologized reflexes of an originally unitary alternation could develop individual idiosyncrasies. Of course, such a development is not an obligatory consequence of morphologization: insofar as the reflexes of a phonological rule continue to be formally uniform, this can be accounted for simply as a result of the fact that they have a uniform source, and have not yet undergone significant change. But if changes in the formal character of the rule occur in its application to individual categories, and do not automatically generalize across all of the related cases, this implies that the rule has in fact been divided into a number of distinct rules.

This is exactly what we find. The most extensively studied morphologized reflex of an originally phonological rule is surely German Umlaut; and as has been noted (Robinson 1975; Janda 1982), this rule shows a clear tendency to develop individual peculiarities in its various instantiating categories which argue for the presence of a number of distinct, category-specific rules of Umlaut. The same result can also be demonstrated from other systems in which a morphologized rule applies in diverse categories (Anderson 1986a): each category corresponds, in principle, to a distinct Word Formation Rule, and in consequence historical change can affect them individually. This is exactly what is predicted if we claim that morphologization involves replacement of a phonological environment by a morphological one (rather than merely adding morphological conditions to phonological ones), since
that claim entails the potential for fragmentation of morphologized alternations.

This conclusion goes directly counter to the scientific instincts of most linguists, but it is important not to let one’s aesthetics interfere with the appreciation of fact. If there are indeed a dozen or more distinct rules in German that involve the change called Umlaut, we naturally want to capture what they have in common – and the pre-eminent way to do this is by having a single rule, triggered in a variety of environments. If there is no single rule of Umlaut, however, as now seems clear, we must look to some other device to express what is common to Umlaut. Of course, the similarities have a historical foundation, as noted above, but there is also a synchronic uniformity (even if only a partial one) to be described.

One way to describe such facts would be to admit a notion of ‘meta-rules’ which formalize redundancies over the Word Formation Rules of a language. A rule of this sort would be a specification not of some particular Word Formation Rule in the language, but rather the type of possible change a Word Formation Rule might perform: something with the content of “the Structural Description of a rule may involve the fronting of back vowels according to the following pattern.” Such a theory of morphological meta-rules remains to be developed, but the class of process-like changes performed by Word Formation Rules like those of Umlaut is not the only possible domain for their application. A language’s discreet affixes may also fall into quite regular patterns, without thereby constituting a single rule. No one would be tempted to say that the English regular plural, third-person singular present, and possessive, or perhaps even the regular past and past participle, are instances of the ‘same’ rule, but the fact remains that all regular nominal and verbal inflection in English is carried out by means of affixes with the form /z/ or /d/. This is a uniformity that ought perhaps to be expressed as a fact about the language’s structure.

To return to the central topic, once a rule is morphologized in some environment, the result is a rule whose formal properties are those of a Word Formation Rule, and not those of a purely phonological rule. The differences in the character of these two types of rule may thus have additional consequences for the precise content of an alternation which has undergone morphologization.

13.3 The morphologization of syntactic structures

It is a commonplace of historical change that many morphological elements can be derived historically from originally independent words. Thus, the
13.3 The morphologization of syntactic structures

English ending -hood that forms Nouns like childhood, manhood, neighborhood, etc. from other Nouns was an independent word in Old English (hād “state, rank, character”), which could be used as the second part of compounds. An originally syntactic collocation developed into a class of compounds (described by a rather general Word Structure Rule); the recurrent second element of these compounds was then further reanalyzed as a derivational suffix introduced by a Word Formation Rule. An originally syntactic structure has been morphologized, and the rule which describes the addition of this affix to certain stems is a historical reflex of that syntactic structure.

There are many differences, of course, between the morphologization of a phonological alternation and that of syntactic construction. One is that in the phonological case, what changes is the formal expression of an existing category. When a phonological alternation is replaced by a Word Formation Rule $/X/ \rightarrow /Y/[[+F_j]]$, the formal expression of the conditioning category $[[+F_j]]$ is changed, but the morphological system (the set of morphological categories of the language) is not. The antecedent existence of $[[+F_j]]$, in fact, is usually necessary if morphologization is to be possible at all. In contrast, the morphologization of syntactic constructions typically creates new morphological categories.

A straightforward example cited in Comrie 1980 is the expression of the notion “along with (NP)” in several Uralic languages. In Finnish, this is expressed by the postposition kanssa added to the genitive form of the NP: hyvään pojan kanssa “good-gen. boy-gen. with.” In this structure, the word kanssa immediately follows the head Noun, but is clearly external to the NP: a modifying Adjective agrees with the genitive case, and kanssa itself is not subject to vowel harmony (cf. tyrön kanssa “girl-gen. with,” not *tyrön känssä). In some related languages, however, the cognate of this word has been reanalyzed as a suffix. Thus, in the Kukkosi dialect of Veps, the suffix is -kā as in lähse-kā “with the child,” which is also subject to vowel harmony (cf. lehmän-kā “with the cow”). Finally, in some dialects of Karelian, the cognate element -kela/kelă has not only been reduced from an independent word to a suffix, but has also become a category in the case system, such that modifying Adjectives agree with their head Noun in the presence of this element (cf. kolme-n-kela lapše-n-kela “with three children”). The grammatical category of the comitative has thus arisen from the reanalysis of an originally syntactic construction as a marker of inflectional morphology.

From the perspective either of American structuralism or of early generative grammar, a change from syntactic to morphological structure is no real change at all, since these theories treated morphology and syntax as essentially the same domain. The recognition that morphological structure has properties of its own, however, is as important in the area of the internal construction
of words (internal 'syntax') as it is in the study of morphologically determined aspects of phonological form. It is thus important to clarify the nature and consequences of transitions from syntactic to morphological status.

13.3.1 Morphology as "yesterday's syntax"
Undoubtedly the strongest statement of the position that principles of the internal structure of words derive from earlier syntactic constructions is that of Givón (1971). Givón's aphorism that "today's morphology is yesterday's syntax" was intended to provide a tool for syntactic reconstruction: if morphological structure provides a faithful but fossilized representation of earlier syntactic structure, that earlier syntax can be recovered directly. For example, while most of the modern Bantu languages have SVO as the dominant word order, they exhibit extensive systems of preverbal pronominal prefixes, including ones that refer to Objects. Givón interprets this as evidence that the system of prefixes arose through cliticization of pronominal NPs to the Verb at a point when the dominant word order of the language was SOV. This claim is said to be confirmed by various other aspects of the morphology of modern Bantu languages, and leads Givón to reconstruct an earlier stage of Bantu syntax with SOV order instead of today's SVO.

The form of this argument is as follows: where a morphological pattern is at variance with the synchronic syntax of a language, it is to be interpreted as a relic of the syntax of an earlier stage. Note that it is a synchronically anomalous pattern which is claimed to represent an archaic state of affairs, not necessarily its particular current instantiations. Thus, it has been argued that English compounds like nut cracker, truck driver, etc. reflect an early OV stage of the language, but this certainly does not entail the assertion that sky scraper, line printer, fuel injector, etc. are Old English formations. The pattern of N-V compounds is a synchronic fact of English, whatever its source, and it is used productively to form new compounds as well as to analyze lexical ones.

It is, however, quite impossible to identify all of "today's morphology" with "yesterday's syntax." For one thing, not all affixes have a (relevant) source in syntactic material: for example, the ending -ir which marks plurality in the Old High German paradigm in (6) above is the reflex of material restructured for phonological and morphological reasons through rule inversion and simplification, rather than an original independent word meaning 'plural' or the like.

Even when we have reason to suspect that a morphological element does originate as a separate word, it may be that its present position does not reflect the earlier position of that word. In Fula (Anderson 1976a) for example,
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Nouns are followed by a suffixed marker of their Noun class, which we can see as going back to earlier pronominal elements that may have served as Determiners. This is not because Fula comes from an earlier stage in which NPs had an internal N-Det (or N-pro) structure, however. There are two indications of this: first, the Noun-class markers in modern Fula have a phonological effect on the initial consonant of the Noun to which they are attached; and second, most of the cognate languages in the West Atlantic family have Noun-class prefixes, not suffixes. In fact, the historical development seems to have been as follows. At some early stage, there was a set of Noun class prefixes, perhaps reflecting cliticized prenominal Determiners. These elements induced phonological changes in the stem-initial consonants. Later, as an innovation entirely within the morphology, the prefixal elements were duplicated at the end of the Noun (a development attested in other Noun-class systems in Africa); and subsequently the prefixal copies in the cl-N-cl structure were reduced, leaving as a trace only their (now morphologized) phonological effects on the root-initial consonant. The result is a structure N'-cl (where N' is the Noun stem N with the proper initial consonantal mutation) in which the linear position of the classifier element does not reflect the position of a syntactically independent word at any stage of its history. From such examples we can see that developments internal to the morphology can alter relations of sequence among morphological elements within a word, thus obscuring their bearing on earlier syntactic states of affairs.

Even where the morphology does reflect earlier syntax without change, the construction thus reflected may not be basic syntax. Indeed, it would be amazing if morphological facts did give us privileged access to features such as (earlier) basic word order, given the difficulty of establishing this from a full complement of surface data concerning the synchronic state of an existing language. Since it is surely surface syntactic patterns that undergo morphologization if any do, our inferences about properties such as basic word order could never be any better than the rather uncertain guide this source of evidence can provide. Most significantly, however, a morphologized structure may have had specialized and non-'basic' properties even at the point it was reanalyzed, so that no inference from it to the properties of more general structures in earlier stages of the language is possible. A case of this sort is analyzed in Comrie 1980, where it is shown that the post-verbal agreement markers of Buryat Mongolian reflect not an earlier VS order, but rather the fact that precisely unstressed dependents of a head (from which agreement markers as cliticized pronouns must be assumed to derive) can appear in post-head position in the language. The suffixed position of the agreement markers derives from the properties of a specialized structure, used when a
dependent is unstressed, rather than from the syntactically motivated S(O)V order of basic sentence elements (which is clearly attested since well before the development of the verbal affixes in question).

An example relevant to this situation can be provided from the structure of several modern Polynesian languages (Chung 1978). Some of these, like Sāmoan, have a set of preverbal Subject clitics, which appear as clitic elements that follow the sentence-initial tense marker and precede the Verb. On the other hand, full NP Subjects appear strictly following the Verb: often finally, and often immediately after the Verb, but never in preverbal position. Can we infer from these facts that Sāmoan once went through a stage with preverbal Subjects, of which the pronominal clitic pattern is a historical remnant? Surely this would be unwarranted—and in any case, it is probably quite incorrect, since we have no reason to doubt that Sāmoan (or the language ancestral to it) was Verb-initial at the point the Subject-pronoun pattern developed. Rather, what is going on in this instance is that the Subject pronouns have been reanalyzed as sentential clitics, and as such have taken on the positional possibilities of such elements. As we discussed in chapter 8, 'second position' is a very common location for clitic elements, and this is precisely where we find the Subject pronominal element. Its appearance in second position does not indicate that Subject NPs were once preverbal: rather, once pronominal Subjects had been interpreted as sentential clitics and not autonomous NPs, the position immediately following a sentence-initial element (i.e., second position within the clause) was one in which they could be realized. The properties of this special construction (exactly the type which is typically ancestral to affixes as the reflexes of independent words) show us nothing about the basic word order of Verb and Subject in earlier stages of the language, but only that it is possible for pronominal elements to be reanalyzed from the status of independent NPs to that of sentential clitics.

These reservations make it clear that we cannot accept morphological structure uncritically as a reflection of (earlier) syntactic structure. This does not at all mean we should abandon the search for syntactic bases for morphological form, however: in fact, exactly the opposite is true. There is every reason to believe that much morphology does represent the reanalysis of earlier syntactic complexity; but since the relation between the two sorts of structure is not simple and direct, it is important to explore the principles involved in the process of morphologization. We take up this problem in one concrete domain below. While this hardly exhausts the subject, it will reveal some important principles relevant to the theory of morphologization.
13.3 The morphologization of syntactic structures

The development of ergative morphology

A classical anomaly in the relation between morphology and syntax is the existence of ergative languages, in which the same morphological category (the absolutive) appears to characterize the (notional) Objects of transitive Verbs and the Subjects of intransitive Verbs, as opposed to a distinct category (the ergative) which characterizes the Subjects of transitive Verbs only. In the examples in (8) from Avar, the verbal-agreement marker shows concord with the intransitive Subject in (8a) and with the transitive Object in (8b), but not with the transitive subject. The distinction between an unmarked absolutive and an overtly marked ergative NP follows the same lines.

(8) a. emen, roqove v,-us:ana
   father, (ABS) home he,-returns
   "Father returns home"

b. instu,-c:a ebelj j,-ec:ula
   father,ERG mother, (ABS) her,-praised
   "Father praised mother"

The problem posed by such languages, of course, is that the categories apparently established by the morphology (absolutive and ergative) do not match those we expect to find in the syntax (Subject and Object). There seem to be two main alternatives: either the correspondence between syntactic and morphological categories is not one-to-one, or the syntactic relations relevant for ergative languages are not the familiar ones.

Once the domains of 'syntax,' 'morphology,' and 'semantics' are properly delimited, it is reasonably clear (see Anderson 1976b) that with the important exception of a few Australian languages (notably Dyirbal), the syntactic evidence overwhelmingly favors the first of these possibilities. Genuinely syntactic principles, that is, systematically treat the NPs we expect to be Subjects as constituting a unitary category regardless of the transitivity of the Verb. These are the NPs that are possible antecedents for reflexives (and which cannot be reflexive themselves); it is this position which the controlled PRO (or missing NP) of 'EQUI' constructions occupies; conjunction formation treats Subjects as grammatically parallel (and distinct from Objects) despite case-marking differences; switch-reference systems depend on identity of Subjects, etc. We must conclude that the syntactic categories of ergative languages are like those of accusative languages, and that it is the correspondence they exhibit between morphology and syntax that is unusual.

There are a number of ways we could describe ergative morphology formally, but for concreteness let us assume the following account. Assume as discussed in chapter 5 that 'agreement' results from mechanisms of the syntax which pass the relevant set of features (in Avar, gender and number),
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together perhaps with a referential index, from an agreeing NP to the morphosyntactic representation of the Verb. As suggested in chapter 4, in languages with both Subject and Object agreement, ‘agreement’ operates from these two positions in some determinate order: on standard assumptions about phrase structure, Object agreement applies first and then Subject agreement. As a result, the (relevant parts of) the morphosyntactic representations of (8a) and (8b) above will be the structures in (9).

\[
\begin{align*}
(9) & \\
& \text{a. } \left[ + \text{Masc} \right] \\
& \left[ + V, \ + \text{Sg} \right] \\
& \quad \left[ \quad \left[ + \text{Fem} \right] \right] \\
& \quad \left[ \quad \left[ \quad \text{Sg} \right] \right] \\
& \quad \left[ \quad \text{i} \right] \\
\end{align*}
\]

On the basis of these representations, we could say that the absolutive case is unmarked, and the ergative arises by the operation of a case-marking rule like (1).

\[
\text{NP}, \rightarrow \left[ + \text{Ergative} \right] \text{ (when properly governed) by } [i[X]]
\]

By this rule, a NP which is coindexed with the outer layer of a two- (or more) layer representation (i.e., a transitive Subject) is marked ergative. The rule of agreement, on the other hand, operates on the inner layer of the representation: a marker (v- for masculine, j- for feminine, etc.) is introduced into the Verb on the basis of the features present in the innermost layer of structure of its Morphosyntactic Representation. This will be the layer agreeing with the Subject, if the Verb is intransitive, or with the Object, if transitive. As a result, ergativity is completely accounted for within the morphology, without the need to assume that ‘ergative languages’ are ipso facto unusual with respect to their syntax.

We can now ask how such a system could arise. In principle, the generalization leading to a rule of ergative case marking could even result from a phonological change, it appears. Suppose a language with basic VSO order has a rule marking Subjects with an ending -s, but leaves Objects

* The internal structure of (9b) is a consequence of the Layering Principle suggested as (12) in chapter 4 above.

7 As in the discussion of Georgian case marking in chapter 6, ‘proper government’ may or may not be the correct way to refer to the relevant relation. This depends on whether or not the agreement representation is actually constructed as a set of features on the phrasal node, and later inherited by the Verb (as head of this constituent). These issues are orthogonal to our present concerns, and we ignore them here by simply calling the relation between an agreement representation and the NPs it indexes ‘proper government.’
unmarked. If this language now undergoes a phonological change by which final obstruents are lost before pause, this might affect (many) final -s markers on intransitive Subjects, because these would also be sentence final, while instances of -s suffixed to transitive Subjects would be followed by the Object NP and thus unaffected. The result might well lead to a reanalysis by which only transitive Subjects are marked with -s, which would thus become an ergative marker rather than a nominative. We know of no example which exactly fits this scenario, though the historical development of ergativity in Chinook agreement comes close (cf. Anderson 1977b). Another phonologically motivated reanalysis which leads to a similar result is the Object clitic system in Yagua discussed by Payne (1983).

A well-attested source for the development of ergative morphology, however, is in the reanalysis of earlier (syntactic) passive constructions. Note that, in a passive sentence like They were accosted by him on the way to the underground we have all of the characteristics of 'ergative' morphology: the notional Object of the (lexically) transitive Verb accost bears the same case mark as an intransitive Subject; the notional Subject of accost has a special marker (the preposition by plus objective case); and the Verb agrees with the notional Object rather than with the Subject. If we do not describe passive sentences in this way, it is because they are generally considered to be related to active sentences by a rule which alters the grammatical relations of the argument NPs of the Verb, making the notional Object into the grammatical Subject, etc. If we were to lose motivation for such a derivational relation, and still wanted to say that Verbs like accost are transitive, the pattern of these passive sentences would no longer be distinguishable from that found in an ergative language. In essence, this is exactly what has happened in several unrelated language families: originally passive constructions have lost their relation to the putative underlying active forms, and as a result their surface form has been reanalyzed as ergative morphology rather than passive syntax.

A particularly well-documented case of this is found in Polynesian, as analyzed in Chung 1978. A language of this family displaying an ergative pattern is Tongan, whose sentences typically show the following pattern: transitive Verbs, which may end in the suffix -Cia (for some lexically determined consonant C), mark their Subject with the ergative particle 'e. In conservative dialects, transitive Objects and intransitive Subjects are marked with the absolutive particle 'a. There is no syntactically derived passive construction. In contrast, some related languages such as Maori show an accusative pattern of morphological marking, with a derived passive construction. Here active transitive sentences mark their Objects with the particle i. Subjects, whether transitive or intransitive, are unmarked. In passive
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sentences, the Verb is suffixed with (a form of) -Cia, the agent has the preposition e, and the notional Object is the grammatical Subject.

The question for the history of Polynesian is whether the Tongan type or the Maori type is original. Chung (1978) shows clearly that it is the Maori pattern, since the following features can be reconstructed for proto-Polynesian:

- Cia was originally a passive suffix for Verbs.
  i was originally an accusative case marker, not a preposition.
  e was originally an agentive preposition, not a case marker.

Each of these points can be established by sound comparative technique, independent of the question of the evolution of case marking. Jointly, they establish that the properties of the Maori structural type are original; those of Tongan represent an innovation, consisting in the reanalysis of a passive structure as syntactically active. Note that transitive sentences are not synchronically passives: Chung shows that the Verbs of such sentences are indeed transitive, not passive, and their agents are Subjects, not oblique agent phrases.

The explanation of what has happened is apparently to be found in properties of the passive construction in Polynesian accusative languages like Maori. This construction has a much wider distribution than the English passive: it is much more common than the active in sheer numeric terms; it is obligatory in certain contexts, such as (non-reflexive) imperatives; and it is commonly used to mark the Object of a transitive Verb as 'affected' by the action. Apparently there is a strong preference for having the affected Object as the surface Subject. If we imagine that this preference is quite old, and that in the history of languages like Tongan it rendered the passive effectively obligatory for a large class of structures, the corresponding active bases from which these passives were derived would simply have ceased to occur as surface forms. When that happened, the syntactically derived status of the 'passives' became opaque, and the formal markers of the construction were simply reinterpreted as the morphology of certain Verbs and of case marking in transitive clauses.

The correlation of case marking with aspect as a product of change

The development of ergative case marking from the reanalysis of an earlier passive construction reinterprets in diachronic terms the claim, common in traditional accounts of ergativity but now thoroughly discredited (see Anderson 1976b and references cited there), that ergative languages have (synchronously) 'passive' syntactic structures, while only accusative languages have active ones. The temptation is to assume that such developments are
always the source of ergative morphology, but this generalization would surely be an exaggeration. We have no evidence indicative of such an origin for many languages of this type, and some reasons for skepticism (such as the existence of productive passive constructions in ergative languages like Georgian). On the other hand, the historical source of ergativity in Polynesian is not an isolated case; and that provides us with the possibility of a historical account of a correlation which is (at least superficially) puzzling in purely synchronic terms.

As is well known, many 'ergative' languages display ergative case marking only under some circumstances, with accusative patterns obtaining elsewhere. A particularly common variety of such 'split ergativity' is illustrated by languages in which ergative marking is confined to clauses whose main Verb is marked for perfect aspect (or in some cases, for a tense form derived from an earlier perfect, as in many Indic languages where a modern past/non-past distinction derives from an earlier perfect/imperfect one). From this frequently observed correlation, some have argued that the surface case-marking pattern of ergative languages is somehow especially suited or appropriate to the semantics of the perfect; but the nature of the connection remains elusive and essentially stipulative.

We would like to claim that the search for such a connection is based on a fundamental misunderstanding of the nature of the correlation to be explained. Ergativity shows up in perfects (or the reflexes of earlier perfects) not because of a particular synchronic affinity between the two, but rather because there are several ways in which aspectual distinctions between perfects and non-perfects tend to be created, and all of these happen to involve the generalization of constructions whose formal properties are 'ergative' in a new perfect, or 'accusative' in an innovated imperfect.

One example of languages with aspectually based, split ergative systems is the Indic family. Originally, Indic (as represented by Sanskrit) had a full range of verbal inflectional marking for tense, aspect, and person. In particular, a set of personally inflected, perfect-aspect verbal forms were found. As an overall generalization about the development of verbal inflection in Indic, however (Bloch 1965), the personal forms were lost and replaced by alternative constructions. In the case of the perfect, the lost forms were supplied by a generalization of the originally passive periphrastic construction with the auxiliary Verb "be" and the participle in -ta. In this structure the 'goal' of a transitive Verb appears not as Object but as Subject, and the Verb's agent appears as an instrumental (hence oblique) phrase.

We may be in doubt about the semantic basis of a correlation between perfect aspect and ergativity, but there is no difficulty in seeing passives as semantically close to perfects. A passive presents the action from the
perspective of the affected Object, and thus, like a perfect, as having already taken place or having been completed. As the original personally inflected, verbal perfect forms disappeared from use, it would thus have been natural for their sense to be supplied by passives. This generalization and alignment with an aspectual category, however, coupled with the simultaneous decline in the use of the personal active forms, led to a loss of the syntactic connection between actives and passives, and the opacity of a synchronic derivation of the (original) passive from active was increased. As a result, just as in the Polynesian case, the formal properties of the 'passive' construction came to be regarded not as indicative of its derivation from something else, but simply as surface markers of structures containing a transitive Verb – here with the added significance of marking perfect aspect. The result is a morphologically ergative pattern of case marking superimposed on an ordinary, underived active syntactic structure for the purpose of marking perfect aspect. This was thereby opposed to the morphologically accusative pattern found in the reflexives of the non-passive constructions that gave rise to the imperfect forms of transitive Verbs.

In languages like Hindi, the resulting aspectual distinction was reinterpreted as one of tense, and thus modern Hindi displays an ergative pattern in past-tense clauses: the Subject is marked with the particle ne (the reflex of an earlier agent marker), and the Verb agrees with its Object if transitive or with its Subject if intransitive. This agreement pattern is exactly that of participle agreement in the pair of structures “I am beaten (by him),” “I am come” which historically underlie the past-tense forms. That the NP not marked with ne in transitive clauses is indeed the Object, however, and not the Subject, is shown both by its syntactic behavior and by the fact that it is marked with the same particle ko when definite as appears with transitive Objects in non-past clauses. Similar (though not identical) facts obtain in a number of other modern Indic languages.

The development here is quite parallel to that in Polynesian: an original, syntactically derived passive construction has lost (or reinterpreted) its connection with its presumptive syntactic source. Once they become isolated in this way, the morphological markers of the construction are analyzed de novo as simply the surface marking of the relevant structure. In Tongan, the structure is simply that of a transitive Verb, while in Hindi and similar languages it is that of a past-tense (né perfect) Verb. The case marker is thus assigned by a rule like (10):*

* The agreement rule for this structure operates over representations like those in (8) above, causing a Verb whose aspect is perfect (or in Hindi, whose tense is past) to show agreement with the NP whose features appear in the innermost layer of its morphosyntactic representation.
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(10) $NP_i \rightarrow [+\text{Ergative}]$ (when properly governed by) $[\nu + \text{Perfect}, \tilde{a}[X]]$

The important point is that there is no direct and intrinsic connection between ergativity and perfect aspect shown by this construction. It is simply the case that both are aspects of the passive, and when passives are the source of an innovated perfect, they bring along their morphological characteristics as more or less incidental formal baggage.

We find a somewhat different source for newly created perfects in other languages: originally possessive constructions. While completely unrelated to the passive, it happens coincidentally that this source, too, leads to ergative morphology when reanalyzed as a perfect marker. As stressed by Benveniste (1952) and others, a construction (or specific Verb) expressing possession is frequently employed in the formation of a new perfect, as is indeed the case in the English construction *I have solved the problem of the origin of life*. Perhaps this development passes by way of a construction like *I have (got) the problem of the origin of life solved*, but in any event there seems to be an intrinsic connection between possession and perfectivity.

Now in fact, in many languages the expression of possession is by means of a periphrastic construction of the "at me is a book" type found in Russian and elsewhere. When this structure serves as the basis for the creation of a new perfect (as in, for example, Breton), we would expect something like "at me is the problem solved" to express "I have solved the problem"; and of course the properties of this structure are precisely those of an ergative construction. The transitive Subject appears in an oblique form (perhaps governed by a Preposition); the transitive Object appears in the Subject (or nominative) case; and the inflected Verb agrees with the transitive Object. Benveniste argues that this is exactly the origin of ergative case marking in the (innovated) perfects of Old Persian, Classical Armenian, Egyptian, and some other languages.

When the derived or periphrastic status of this structure becomes obscured, the change that results is parallel to that deriving perfects from passives. The original properties of the oblique possessor construction, once this comes to be employed for the expression of perfect aspect in non-possessive clauses, become opaque, and the formal marks of the construction are reanalyzed as simply the morphological marking of the perfect. The importance of this development for our purposes is the fact that it is completely independent of the possibility of generalizing a passive to make a new perfect, but 'conspires' with that alternative in that both have the result of assigning ergative morphology precisely to the newly created perfect forms. In neither case, however, must we interpret this as resulting from some supposed affinity of perfect and ergative *per se*.

This conclusion becomes even clearer when we consider a third possible
way by which languages can develop a distinction between perfect and imperfect, which has nothing whatsoever to do with the two sources considered thus far, but which happens to produce the same sort of morphological result. The development in question is attested in the history of Georgian. Here, it was a new set of imperfect forms rather than a new perfect that was created; the newly created imperfects were associated with a morphological pattern of the accusative type, but since this took place in a language whose basic case-marking pattern was ergative, the result was again an aspectually based, split-ergative system of much the same (superficial) type as that of, for example, Hindi.

As we saw in chapter 6, Georgian Verbs can appear in one of a large number of tenses, divided according to their associated case-marking pattern (among other things) into three series. What is of interest to us is the fact that case marking in the 'Present' series of tenses is of the accusative type, while in the 'Aorist' series it is usually described as being ergative. The distinction between the tenses of the 'Present' and 'Aorist' series is not presently reducible to a single semantic dimension of aspect (or anything else), but the facts of Old Georgian give us good reason to believe that these originally differed in that the 'Present' tenses were imperfective while the 'Aorist' tenses were perfective. In this case, the split ergative system cannot apparently be accounted for by deriving the pattern of the 'Aorist' tenses from an earlier passive (or possessive) construction, since comparative evidence shows that the pattern associated with these tenses is in fact original, and it is the accusative pattern of the 'Present' series that is an innovation.

Anderson (1977b) suggested (echoing earlier proposals in the traditional literature) that the construction found in the present series should be derived from original 'Object demotion' structures. Many languages have a secondary construction for transitive Verbs (sometimes, when this option is systematic, labeled 'antipassive') in which their Direct Objects appear in an oblique case (or in a Prepositional Phrase), and the Verb is treated as intransitive. This structure commonly indicates that the action referred to was incompletely carried out, or that it affected the Object only partially, etc. In English we have only lexicalized pairs (such as John shot at his neighbor vs. John shot his neighbor; My wife likes to drink from my glass of wine vs. My wife likes to drink my glass of wine, etc.), but in other languages this relation is quite systematically carried through. In some, indeed (e.g. Finnish), the distinction between such partitive marking of Direct Objects and normal accusative marking is clearly used as a way to express the difference between imperfective and perfective aspect.

Let us imagine that Georgian was originally fully ergative, and that it had such an Object-demotion (or anti-passive) construction. Now suppose that
this construction came to be analyzed as the expression of imperfective aspect, as a consequence of its being used to describe incompletely carried out actions. In the resulting imperfectives, the Subject of transitive Verbs would be treated exactly as the Subject of an intransitive, since detransitivization is exactly one of the properties of Object-demotion constructions. Furthermore, the notional Direct Object of such a detransitivized Verb would be assigned a distinct marker (the appropriate oblique case or Preposition), which could be interpreted as an accusative case. If the morphological properties of an Object-demotion construction were then re-interpreted as assigned to basic transitive clauses to mark imperfective aspect, the result would be that these clauses would be assigned an accusative pattern, in the context of a prevailing ergative pattern in perfective clauses.

Harris (1985) shows in considerable detail that this scenario is essentially correct, though greatly oversimplified. For one thing, the actual case-marking pattern of the modern Georgian 'Aorist' series is not ergative but 'active'; for another, marking Objects as oblique (or deleting them) in Old Georgian did not result in detransitivizing the Verb. Nonetheless, it can be shown that the 'active' pattern of the Modern Georgian Aorist series is itself an innovation, based on an original pattern that was ergative; and the absence of detransitivization is a concomitant of the innovated active system, not the original ergative one. When we place it correctly in time, the development hypothesized above from a (detransitivizing) Object-demotion construction to an accusative system for the marking of imperfective aspect is well supported. Harris shows that this development explains a wide variety of idiosyncratic and very specific properties of the morphological structure of the Present series of tenses, and not only its broad outlines. As a result, there is little remaining doubt that split ergativity can arise (and has in fact arisen, in Georgian) through the reinterpretation of Object-demotion structures as the imperfective aspectual forms of normal clauses.

Such creation of accusatively marked imperfective forms in a language otherwise displaying ergative marking is obviously quite distinct from the creation of ergatively marked perfects in accusative languages; but the resulting split along aspectual lines is superficially the same. We have now seen three distinct ways of creating new aspectual forms (generalizing passive or possessive structures to make a perfect; or generalizing Object-demotion structures to make an imperfect). For reasons internal to each of the three, the result in each case is a split in case marking by which ergativity is associated with the perfect and accusativity with the imperfect. The historical account makes the real basis of this correlation clear, however, and makes it unnecessary to hypothesize some intrinsic connection between the semantics of aspect and a semantic interpretation of case marking. The result is
(potentially) a rather clearer focus on such properties of synchronic systems as may actually have a semantic basis.

**Opacity and the conditions for morphologization**

In the discussion above we have seen several instances of the same kind of development, where an originally derived or syntactically complex construction, whose morphological markers were straightforwardly correlated with syntactic categories, is reinterpreted as a syntactically basic structure. In each case, the original morphology is preserved but comes to bear a more complex relationship to syntactic categories. Such changes, and the states they result in, make an important point: morphological evidence alone is insufficient to establish the 'basic' or 'derived' status of a construction, or the categories of syntactic structure to which its elements belong.

Traditional grammar viewed 'syntax' as a sort of 'applied morphology,' in which the (apparent) morphological categories were primary and the (covert) categories of syntactic structure were associated with these rather directly, as "the uses of the Nominative," etc. Much subsequent discussion continues the implicit assumption that the correspondence between morphological and syntactic categories is a simple one, and it is thus quite important to establish that this is not true in the general case. Morphological marking often represents the accretion of complexity from many sources over time: the fact that these markers are assigned by rule on the basis of syntactic and lexical structure does not mean that the rules involved are simple ones.

In section 13.2 above, we suggested (following Baudouin de Courtenay and Kruszewski) that the principal mechanism involved in the morphologization of phonological rules is the development of opacity, or the loss of motivation for deriving a surface form from a more abstract underlying form by phonologically motivated principles alone. When the properties of surface forms are no longer manifestly correlated with apparent phonological generalizations, but are better aligned with morphological categories, it seems that linguistic change tends to emphasize this by replacing originally phonological rules (which happened to apply in some morphological categories and not others) with ones that operate directly in terms of the morphology. The morphologization of syntactic rules is in fact based on essentially the same principle.

In the examples we have seen above, and others, what happens is the following: originally, two constructions (active and passive, directly vs. obliquely transitive, etc.) are correlated in such a way as to motivate a syntactic derivation of one from the other or a lexical relation between two syntactically distinct structures. Subsequently, however, one construction comes to be used systematically (and the other systematically excluded) under conditions that
define some structural category: the passive in (some) Polynesian languages is used wherever there is a directly affected Object, the Indic periphrastic passive indicated perfect aspect, the oblique-Object construction in early Georgian was a marker of incompleted action (hence imperfective aspect), etc. The result is that in the relevant circumstances, the complementarity of the two (originally related) structures makes the syntactic derivation of one from the other less transparent. The resulting development consists in interpreting the surface form of one structure not as reflecting its derivation from the other, but rather as the overt marker of the category with which it is correlated — applied to a syntactic structure which is no longer motivated as derived from a non-basic source. This is simply the syntactic analog of morphologization as it results from the development of opacity.

Taking the account above quite literally, however, it would appear to predict that whenever a syntactic rule is obligatory (and thus excludes the related, underived structure from the environments in which it applies) this ought to lead to its morphologization. That would clearly be just as wrong as a corresponding claim that any phonological rule which is not completely transparent must be morphologized. In fact, both syntax and phonology appear to involve at least some rules that are obligatory and partially opaque; and while this character may well be a necessary condition for morphologization, it surely cannot be a sufficient one as well.

In order for some distribution of markers to be interpreted as assigned to a morphological category rather than to a syntactically derived structure, there must be some category available to serve as the basis of the resulting morphological rule. As a result, we would expect morphologization only in those cases where the obligatoriness of an originally derived structure coincides with some possible morphological category.

The significance of this condition can be seen by comparing similar linguistic systems, where morphologization has taken place in some but not others. Anderson (1980) cites several families of American Indian languages, in each of which a passive construction has become obligatory under certain circumstances. In some of these, the result has been morphologized. For instance, in the Algonquian languages, an original passive has been reinterpreted either as part of the system of agreement marking in active clauses (as in Potawatomi, see chapter 6 above), or as a marker of indefinite or inanimate Subject forms. In Navajo, in contrast, there is no reason to believe that the obligatoriness of passivization under determinate conditions has provoked a reanalysis of

* This is essentially the position of 'Natural Generative Phonology,' an extreme limitation on the possibility of abstract phonological structure which is generally regarded today as implausible. See Anderson (1985b: ch. 13) for discussion.
the rule which would eliminate the relation it describes between two distinct syntactic structures.

The key to the difference between these two cases lies in the conditions which govern passive in each language. In Algonquian, passive became obligatory for certain combinations of Subject and Object person and excluded for others: when third person acts on first, for example, passive was required, while when first person acts on third it was not possible. Since the circumstances in which the morphology of passive appeared align straightforwardly with the morphological categories of agreement, it was easy to reinterpret the morphology as simply part of the apparatus marking Subject and Object agreement. In Navajo, in contrast, the conditions of obligatory passivization are vastly more involved, and depend on an extensive categorization of beings as relatively more or less autonomous in controlling their own actions. Passive is required when a relatively lower actor on this hierarchy (an insect, for example) acts on a relatively higher being (a large animal or a human, for example). The intricacy of this classification defies reduction to a unitary morphological category, and thus morphologization has not taken place.

Some examples suggest that the category with which a morphologized rule is associated must be one which is already established in the language. Thus, in Nitinaht passive is obligatory for certain combinations of Subject and Object NPs in a way reminiscent of the Algonquian and Navajo systems. The Nitinaht classification of NPs apparently requires passive when the Subject is inanimate and the Object animate (as well as in certain person combinations), but does not further subdivide the class of animates in a quasi-continuous fashion as in Navajo. In order for passive to be morphologized, Nitinaht would only have to recognize a categorial distinction between animates and inanimates, which is certainly a possible morphological category, but one which does not otherwise function in this language. The rule has not in fact been morphologized (that is, clauses with passive form have actually undergone a passive rule, rather than simply having appropriate morphology assigned to them), and we could attribute that to the absence of the relevant category of animacy in the language's morphology.

While plausible, however, this further strong requirement that the category in question be a pre-existing one cannot be correct, since in some cases the morphologization of a syntactic construction is precisely the mechanism by which a new category is created, as in the case of Indic perfects or Georgian imperfectives. The strongest absolute constraint on morphologization that seems tenable is that it must be possible to interpret the conditions of obligatoriness as at least a potential morphological category in order for morphologization to occur. This suggests the significance of research into the
13.3 The morphologization of syntactic structures

substantive range of possible morphological categories in natural languages (such as that represented in Bybee 1985), and on the extent to which parameters of an existing system determine the directions in which it can be extended.

13.3.2 Clitics and morphologization

The cases we considered above all involved fairly radical re-interpretations of the syntactic structure of a construction. Morphologization in these examples has preserved the surface form of words in the construction, but re-interpreted it as less opaque syntactically. A much more commonly cited type of change involving morphologization is rather less extreme, however. This is the reduction of originally independent words to the status of affixes, generally assumed to pass through a stage of cliticization.

The example of the comitative in Karelian, taken from Comrie 1980 and cited at the beginning of this section, is typical. In the form kolme-n-kela lapše-n-kela “with three children” the ending -kela/-kelä, originally an independent word meaning “along with,” was argued to have become an inflectional affix on two grounds. First, since it is subject to word-internal Vowel Harmony, it has evidently lost its autonomy as a word; and second, since modifiers of Nouns with this suffix take it as well, it is evidently functioning as the marker of a category determining modifier–head agreement, a prototypical inflectional function. We must keep these two aspects of the development separate, since cliticization does not by itself imply reanalysis as an inflectional affix. English is and has, to take an extreme example, are clitics in examples such as John's the one that's got a banana in his ear without our having any reason to believe that they have somehow become inflections on John and that respectively.

In the framework of chapter 8, English 's is a simple clitic, whose clitic property is the purely phonological one of lacking the prosodic structure of an independent word. Its position in the sentence is exactly the position of the related auxiliary Verb is or has. Other clitics, however, which display syntactically unusual positioning, are accorded a different status. These special clitics we proposed to treat as ‘phrasal affixes’: material introduced into phrases by rules that are highly parallel to the affixation rules that operate on words.

On this basis, we can provide a straightforward account of the development of words into affixes through cliticization. Let us take as an example the (rather surprising) case of modern English -n't, which is argued in Zwicky and Pullum 1983 to have become an inflectional affix. Though its alternation with the full form not certainly predisposes us to treat this as at most a simple clitic form, Zwicky and Pullum show that it displays all of the characteristics of a word internal affix: formal and semantic idiosyncrasy, defective
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paradigms, syntactic solidarity with its base, etc. On the other hand, it is equally clear that this element originates as the full word not, and thus can serve to exemplify the transition from one status to the other.

What appears to have happened is as follows. For reasons connected with the prosody of sentence particles like not, this word originally developed a simple clitic form in (some subset of) the positions available to the full word form. The clitic nōt was prosodically dependent on a preceding word, and subject to vowel reduction and loss. This resulted in the form -n't which attached to whatever word the word-order rules of the language placed it adjacent to. However, the range of positions in which not appears is limited by its function as a sentence adverbial: especially when unstressed, these elements typically appear immediately following the first auxiliary within the Verb Phrase. This position is thus the one in which -n't would generally be found: in second position within the VP. Second position within a given phrase, however, is a common position for the location of clitics, and the (originally simple) clitic form -n't would thus be eligible for re-interpretation as a second-position (special) VP clitic instead. The result is not a change in surface form, but rather in the underlying grammar: negation is thereby reanalyzed as (at least potentially) a phrasal property of VP, and not exclusively as the meaning of the lexical item not. This phrasal property would then be realized by a rule of affixation introducing the affix -n't in second position in [+Negative] VPs.

Other phrasal properties of English VPs, however, such as agreement and tense marking (inherited as 'head features' from the phrasal properties of the clauses in which they appear), are in fact reassigned to the word that constitutes the head of the relevant VP: the initial Verb, where they are realized as word-level morphological properties. Since special clitic -n't in second position would in fact always follow a Verb, it might be reinterpreted as a word-level affix, rather than a phrasal affix (or special clitic). As Zwicky and Pullum show, this is essentially the stage reached in modern English. Descriptively, Verb Phrases can be treated as bearing a property [+Negative]. The phrasal value [+Negative] can be realized as the element not in second position; but if the head (i.e., the first Verb) of the VP is an auxiliary, the value [+Negative] may be reassigned from the phrasal node to its head. In this position, its realization is determined by principles of word (rather than phrase) formation, and the properties cited in Zwicky and Pullum 1983 represent the expected behavior of what is effectively an 'inflectional' property of the auxiliary Verb.

If such an apparently inflectional property were further reanalyzed as being assigned to Verbs directly in the syntax (and not inherited from a phrase node that dominates them), we might find further changes. In the Karelian example, the originally independent word, having passed through the stages of simple
13.4 Analogy

clitic and special clitic final in NP to be treated as a morphological property of Nouns, is now the marker of a property which can in its turn be passed from the head Noun of its NP to other elements (modifiers) within it.

The operative mechanism here is a simple one. When (some form of) an element becomes specialized in use in a way that limits its positional freedom to locations which are possible for special clitics, it may be morphologized as the marker of a phrasal property, introduced by a special clitic rule of phrasal affixation. If the host with which a special clitic typically occurs belongs to some specific word class, it may further be reanalyzed as introduced by a Word Formation Rule applying to that class. Others factors, especially semantic and prosodic ones, are of course relevant to the treatment of individual examples, but the primary role in this development is played by rules of special cliticization, serving as intermediaries between the status of fully independent words and that of a Word Formation Rule.

13.4 Analogy, or changes in morphological rules

To this point we have been discussing cases in which some aspect of the morphology has its origins in another area of the grammar: the phonology or the syntax. Under the heading of 'morphological change,' however, we must also include instances in which it is the morphology itself that undergoes change, without involving extra-morphological material. Unfortunately, theories of such changes are not well developed, and real results or established principles are hard to find. Explicit theories of morphological structure within the context of a full formal grammar are still comparatively new, and the literature devoted to change in such systems is quite limited. The discussion here focuses on the central category of morphological change in traditional descriptions: analogy.

13.4.1 Classical analogy

The notion of 'analogy' as a category arose through the study of its opposite: sound change. In order to sustain the claim that linguistic change affects sounds, independent of the words in which they appear and which therefore proceeds without (lexical) exception, it was necessary to recognize two other ways in which languages in fact change: through borrowing, and through analogy. Though it is often difficult to identify specific forms as borrowed (vs. inherited), the mechanism involved seems theoretically simple enough. The same cannot be said for the mechanism of analogy.

As an example of an analogical change, we take the development of the Old English Noun *bǣk* "book," plural (nom. and acc.) *bēc*. The uumlaut in
this plural form is quite regular for Nouns of its class, and still appears in modern English in the word *goose/geese*. In terms of sound change alone, we would expect the Old English plural *bēc* to develop into modern *beech* by palatalization of /k/ following the front vowel /e:/ and vowel shift (as in the isolated *pluralia tantum* Noun *breeches*, from OE *bēc* beside singular *brēc*). In Middle English, however, the form *bēc* was replaced by *bōkes*, obviously not as the result of some hypothetical sound change shifting /eːc/ to /oːkes/ but rather, on the analogy of other plural forms with /-(e)s/ and no umlaut, such as *stōn/stōnes*, etc. Such extensions of a regular pattern to cover new cases form the core of the class of changes known as analogies in traditional historical linguistics.

The mechanism of change often proposed as a formal account of analogy is the device of the analogical proportion: one establishes a sort of equation, such as (11), and "solves for *X*" to arrive at the analogically created form.

\[(11) \quad \text{stōn:stōnes} = \text{bōk:}X \]
\[X = \text{bōkes}\]

Actually, there is a certain amount of confusion in the literature between the set(s) of actual forms involved in such a proportion as (11) and the explanatory mechanism that underlies the change. If proportional analogy is to 'explain' such changes as the replacement of *bēc* by *bōkes*, we must determine the extent to which it provides an account of exactly what analogical changes are possible. Manifestly, not every set of three terms makes up a relevant proportional base for an analogy; consider the proposed analogies in (12).

\[(12) \quad \begin{array}{l}
\text{a. book:shoe} = \text{Fred:}X \\
\text{b. book:look} = \text{bomb:}X \\
\text{c. book:cover} = \text{housed}\end{array}\]

The 'proportion' in (12a) is clearly linguistically meaningless, since we have no possible way of solving it for *X*. This shows us that, at minimum, the terms of a proportion must be related in form and meaning. Note that neither is sufficient in complete isolation: we can certainly solve (12b) for *X* = *lomb*, but once we have done so we have no idea what the resulting form might mean, and thus no idea what to do with the solution. In (12c), on other hand, it is clear that a value for *X* could mean something like "outer surface of a house," but the proportion provides no basis for predicting what phonological form this item might have. Clearly, then, a valid proportional analogy must be based on cases where a regular relation in sound reflects a regular relation in meaning.

While clearly necessary, this is still not a sufficient condition, however. From the proportion in (13) below, it is not possible to create the form *heye*
“see,” since the relation between the two terms on the left is totally isolated in the language.

\[(13) \quad \text{ear:hear} = \text{eye}:X\]

Similarly, the creation of *spice* as the plural of *spouse* on the analogy of *louse*: *lice* seems merely a joke. Even the morphologically motivated connection between *louse* and *lice*, while not totally isolated, is too marginal to serve as the basis of a valid analogy.

### 13.4.2 Structural interpretations of analogy

These points were generally understood, and the underlying mechanism of proportional analogy was appreciated by many earlier writers. Bloomfield, for example, speaks of analogy as the “displacement” (by which, in context, he means “extension”) of “analogic habits” – i.e., of the regular patterns of the language (Bloomfield 1933: 405). A valid analogy is thus always based on a valid and (reasonably) general *rule* of the language. Where no rule relates two forms (as in the case of (13) above), they cannot serve as the base of an analogical proportion. Of course, for Bloomfield the notion of a rule was limited to patterns of association among surface forms, and hence the only rules that could serve as bases for analogy were similarly relations among surface forms. In principle, however, what is crucial is that analogies must be based on the grammatical structure of the language, and not on (possibly adventitious) resemblances between actual forms (whether surface forms or more abstract representations). As conceptions of what constitutes this structure have changed, so have the boundaries of potential analogies.

Earlier, de Saussure had also seen the dependence of analogy on the rules that constitute a language’s grammatical system. In fact, it is essential to understand this in order to make sense of his superficially dramatic claim that analogical change is no change at all, from the point of view of *langue*. On de Saussure’s view, forms that we see as analogically created actually existed all along, as potentialities of the system. Thus, insofar as English at the time of the creation of *bokes* contained a rule forming plurals in *-/e/s/*, and a Noun *bök*, the form *bokes* was thereby implicit. If it was not actually used, this was for reasons de Saussure ascribed to usage: the alternative form *hec* was used instead, but this was not really a fact about the *system* of the language, which is constituted by its rules and not by its patterns of usage (or *parôle*). Accordingly, so-called analogical ‘change’ is equally a matter of *parôle*: the old, non-regular form goes out of use, and the ‘new,’ regular form comes to be used more.

On these views, the basic mechanism of analogy is the extension of an existing rule to cover new forms. The rule can be instantiated by a proportion
among surface forms, but it is the rule itself (not the forms that make up the proportion) that govern the change.

Consider now the replacement of older *kine* by *cows* as the plural of *cow*. On the picture of the lexicon adopted here, the form *kine* had lost its regular status and become a lexically listed idiosyncrasy as a result of the decline of earlier -n stems. The lexicon of early modern English thus contained this form as the overtly listed [+ Plural] form of *cow* (while words with regular plurals in -(e)s/ needed no lexical listing for their plurals). The absence of the word *cows* at this point follows from disjunctive ordering, since a lexically listed form takes precedence over one created by rule.\(^\text{10}\) When the form *kine* was subsequently lost – perhaps through simple failure of a later generation of speakers to acquire the irregular item – the result was that the lexical entry for *cow* no longer contained a listed plural. The plural produced by rule (*cows*) would thus occur where required, since there would no longer be another form to block it by disjunction. Similarly, if *kine* were to develop a special sense (as it arguably has, insofar as it occurs at all in English today), parallel to the specialization of *brethren* as no longer simply the plural of *brother*, this would also serve to dissociate it from the lexical entry for *cow* and thus to allow the form *cows* to surface.

In many instances, then, analogy involves simply the loss of an irregular form, or perhaps a minor restricted subregularity. The replacement of *bēc* by *bōkes* is of this latter sort. The umlaut rule was originally quite general, and probably phonological in character; but by the time of early Middle English, the rule had been morphologized and only described the shapes of a few isolated, lexicalized Noun plurals. Simple loss of the (arbitrary and unpredictable) listedness of the umlauted plural *bēc* would then entail its replacement by *bōkes*, as the (now regular) rule of plural formation is no longer blocked by a more specific form in its application to {/bo:k/, [+ Plural]}.

Such cases are rather straightforwardly matters of simplification of the grammar through the loss of irregularity, as urged some years ago by Kiparsky (1965). Most valid instances of 'proportional analogy' result simply from the omission of morphological complexity, principally through the loss of irregular or idiosyncratic formations. In Saussurean terms, the system of *langue* is induced on the basis of observation of acts of *parôle*, and if speakers simply fail to learn (or adopt) some point of arbitrary usage, the result is that its place is filled by the product of the language's regular patterns. Such 'analogy' is not a primitive notion of change *per se*: it is simply the extension of an antecedent rule-governed relationship between form and meaning to new

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See the discussion of disjunctive ordering in word formation in section 5.3.2 of chapter 5 above.
cases. Of course, the coherence of this account depends on the assumption that the morphological patterns of a language are described by a system of rules (and not merely as a lexicon of formative elements or morphemes).

The most extensive attempt in the traditional literature to provide a genuinely theoretical understanding of the operation of analogical change is that associated with Kurylowicz (1949, 1964, and elsewhere), whose goal was to find principles that govern the cases in which analogy could (or could not) operate. In part, the principles he proposes follow definitionally from his understanding of analogy; in part they constitute (essentially unexplained) empirical generalizations about circumstances in which such change can be seen to have taken place. Such observations, insofar as they can be shown to be valid, form a natural domain for further research on morphological change, since it clearly ought to be possible to establish them as theorems that follow from the nature of linguistic structure.

Kurylowicz’s theory is based on the model of proportional analogy, but he makes it abundantly clear that not all proportionals are well formed, even where they involve related terms. Thus, write:writer = receive:receiver is valid, but write:receive = writer:receiver is “nonsensical as between write and receive there is not only no grammatical relation but not even a lexical one” (Kurylowicz 1964: 37). In other words, one side of a proportion must instantiate a relation between two (classes of) forms that is governed by some rule of grammar; the other side represents the extension of this rule to other forms. A proportion relates ‘basic’ forms to forms “founded” on them, and a relation of foundation \( a \rightarrow b \) must exist in order for \( a:b = c:d \) to be admissible as a proportion.

Relations between founding and founded forms play much the same role in Kurylowicz’s system that rules play in a generative grammar, but there are also important differences. Most interestingly, if \( b \) is founded on \( a \), this means that the existence of \( b \) presupposes the existence of \( a \), rather than that \( b \) is constructed by starting with \( a \) and adding something. Thus, the stem of a paradigm is founded on the various fully inflected forms, rather than vice versa. Kurylowicz regards the grammar as a set of relations among full surface forms (much as de Saussure did: see Anderson 1985b), rather than as a set of rules specifying the construction of complex forms from simple components. In fact, the difficulties that arise in views of morphology based strictly on morphemes construed as minimal signs discussed in the present work suggest that this picture may merit more consideration than it has sometimes received.

In terms of his notion of the relation between founding and founded forms as representing rules of grammar, Kurylowicz proposes a number of interesting generalizations about morphological change, whose interpretation in other
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frameworks can be illuminating. One of the more significant of these proposed ‘Laws of Analogy’ is the fourth, formulated as (14).

(14) When a form undergoes differentiation as a consequence of a morphological change, the new form corresponds to its primary function and the original form is reserved for the secondary function. (Kuryłowicz 1949; my translation)

This includes the case of old inflectional patterns that remain in fossilized form, corresponding to some secondary sense or derived function of the original use. English examples include *straight* (originally a past participle of *stretch*), *brethren*, *elder* (originally the comparative of *old*, but now specialized as a Noun or an attributive Adjective referring to persons having priority over others by virtue of age), etc. The content of (14) is the claim that in pairs like *straight/stretched*, *brethren/brothers*, *elder/elder*, etc., where one form is an analogical innovation, it is the new form that will carry the primary function (participle, plural, comparative, etc.), with the original form preserved (if at all) only in some secondary, specialized use.

In terms of the morphological theory of this book, we can describe these cases as follows. In forms such as *straight* and (the Noun) *elder*, what happened was that the secondary uses (the past participle used as an Adjective, the comparative Adjective used as a Noun) became autonomous lexical entries as they developed semantic specializations not applicable to the entire lexical entry from which they were (originally) derived. This lexical autonomy was not noticeable as long as they remained homophonous with the productively derived forms from which they came. When the grammatical system of the language changed, however (generalizing the ‘weak’ past formation in -*ed* for Verbs, eliminating umlaut as a concomitant of comparative formation for Adjectives, etc.), the changes in the relevant rules had no effect on these separate lexical items, since they were no longer synchronically derived by the (now altered) Word Formation Rules in question. The replacement of past participle *straight* by *stretched*, that is, had no consequences for the (lexical) Adjective *straight*. Forms such as *brethren* or *elder* (in adjectival usage) are similar: again, the association of a specialized sense with only one (or at least a proper subset) of the forms built on a lexical base results in lexical autonomy for the relevant form in that sense. As it acquired its distinct interpretation, *brethren* became a (morphologically underived) *pluralia tantum* Noun distinct from *brother*; and when the plural form of *brother* became *brothers*, this change had no effect on *brethren*.

The lexical autonomy of such secondary uses follows from a strict interpretation of what it means to be a lexical entry. In particular, insofar as only some (grammatically characterized) uses of a lexical item are associated
with a specialized sense, the implication is that these forms together with that sense constitute a piece of lexical knowledge (or 'lexical item') distinct from the original, unspecialized item. Typically, as in the case of *pluralia tantum* Nouns like *brethren*, this item is a member of the same lexical category but has a defective paradigm, while in other cases (as with *straight*) it is assigned to a different word class. From this we can conclude that when an inflected form develops such a specialized sense, not predictable from the semantics of its base form taken together with the category in which it appears, the result is that this surface form is separately lexicalized, even when its shape is predictable from the language's regular morphology. As a consequence, changes in regular morphology have no effect on the new item, insofar as the Word Formation Rules in question are no longer involved in its formation.

We can contrast these cases with others (Kiparsky 1974) which might appear to falsify (14). Specialized expressions such as *Toronto Maple Leafs*, *saber-tooths*, *still-lifes*, etc., built on formally irregular words (cf. *leaves*, *teeth*, *lives*, etc.) are clearly innovations, but here the regular formation is associated with the secondary rather than the primary function. Again, what has happened is the creation of a new lexical entry. In this case, though, it is not some grammatically characterized member of a word’s paradigm that is involved in the new formation, but the basic, unspecified form. Simply by failing to transfer the entire paradigm (with its specific, irregular forms) to the new lexical entry, morphologically derived forms of the new item will be produced by the regular rules of morphology. The difference between the two sorts of case is that in the first type (*straight*, etc.) a morphological change has taken place: the rules for forming past participles, etc. have changed, leaving unaffected the lexically idiosyncratic forms that were etymologically but not synchronically derived by those rules. In the second class of cases (*Toronto Maple Leafs*, etc.), the new lexical entry has been created *after* a change in morphology that left some irregular residual forms. Insofar as the irregularity involved is not also incorporated into the new form, the result is a regularly inflected 'secondary' form – which, however, would not fall under (14) since the differentiation follows, rather than being brought about by, the morphological change.

The contrasting treatment of these two classes of example provides valuable evidence about the conditions and consequences of lexicalization, and illustrates the sort of information we can obtain about the structure of synchronic morphologies through the study of regularities of morphological change. The literature dealing with the historical morphology of the Indo-European family is full of such changes, grouped into apparently natural classes designated by purported 'laws of analogy' such as (14). The analysis of these cases, and their explanation on the basis of principles of morphological
structure, remains a potentially fruitful source of illumination concerning the nature of such principles.

13.5 Conclusion

The study of how language changes is of considerable interest in its own right, as has been realized ever since it was first observed that linguistic change is systematic in nature. In the case of morphological change, this involves consideration not only of changes in the system of Word Formation Rules of a language, but also of changes that consist in the reanalysis of originally phonological alternations or syntactic constructions as morphological in character.

This chapter has also urged the position that there is another important reason to study morphological change. Especially in the domain of morphology, where much that we find is the product of historical change operating on originally non-morphological material, it is important to recognize that what we find is the product not only of what is possible, but also of what can come into being. A proper appreciation of the way in which linguistic structure is a product of the interaction of its parts thus cannot omit an understanding of the possible mechanisms and channels of historical change. It may not be possible to understand the range of possible systems that are instantiated by the languages of the world in terms of their synchronic character alone.
14 **Morphology as a computational problem**

In this final chapter, we turn to a different area in which the choice of an appropriate theory of word structure is important. This is the problem of how a computational system might be designed to ‘parse’ individual words in a natural language. The notion of computational parsing is most familiar in the syntactic domain, of course, where it refers to the process of recovering structural descriptions for natural-language sentences from a string of words in light of the system’s representation of the syntax and lexicon of the language in question. Analogously, ‘parsing’ in morphology is the process of retrieving the information carried by particular words, as they contribute to the meaning and the structure of larger linguistic constructions within which they appear.

14.1 **Reasons to study morphology as parsing**

When we ask in a computational system for an account of the information carried by individual word forms, there are two rather different sorts of motivation we might have, and the extent to which we want to pursue a linguistically well-motivated analysis will depend on the goals of the analyst. An understanding of this difference, in turn, is important in determining the sorts of criticism of a given system that might be appropriate. The first set of motivations can be identified (somewhat pejoratively, perhaps, in a work devoted to questions of general linguistic theory) as ‘technological’ reasons.\(^1\) In these cases, the question of what information a word form carries is posed because we want the answer. Examples of such problems would include the development of a morphological parser

\[\text{In support of a syntactic parser for a language when the form of words bears syntactically relevant information (i.e., in most languages); or}\]

\(^{1}\) See Sproat 1989 for an interesting and substantial discussion of systems of the sort alluded to here and some of the problems they present for the interaction of linguistic theory and computational practice.
As part of a text-to-speech system for a language like English, where some choices of pronunciation depend in part on morphological structure (see differences like fathead vs. father); or
As part of a text retrieval system, whose goals might include problems such as finding all of the references to, for example, flowers in a given text written in a language where the relevant lexical stem could appear in multiple forms (e.g., French fleur and floral); or
As part of a text-manipulation utility, performing such tasks as (i) hyphenation; (ii) spelling correction; (iii) monitoring the potential well-formedness of input text...; or
In reverse, to construct new words from their morphological characterization, as part of a text-generation or Machine Translation system.

In developing a procedure for syntactic analysis, we generally need to start from an identification of the words in each sentence or text. If our interest is in the syntax, we may not care how this information about words is derived, so long as it is made available expeditiously. Similar considerations obtain in identifying the lexical content of documents. Some work on document-retrieval systems provides a rather precise procedure for searching a large database, founded on the construction of lexical profiles of each potentially relevant document. This method requires a technique for identifying which of the words in a document are the same and which are different — apparently a rather straightforward matter of string comparison for a language like English, once one makes some provision for stripping away a small number of common inflectional affixes such as -(e)s, -(e)d, etc. Extending this approach to documents in languages with substantial morphology (such as Russian) would obviously necessitate a more principled way of abstracting away from morphological differences in the surface shapes of the 'same' lexical item, but that might be quite irrelevant insofar as our interest is in English texts.

When we approach morphological problems for purely applied reasons such as these, the primary criterion of adequacy can reasonably be said to be efficiency, rather than theoretical motivation. If the system performs its task quickly and without complaint, we may not care whether it conforms to linguistic principles or generalizes to languages with very different structures than that for which it was intended.

In contrast, we might ask the question of how morphological form can be related to content in explicit, computational terms for 'scientific' reasons: because we want to improve our understanding of the question, rather than because we have a use in mind for the answer. On this basis, the linguist
interested in morphology from a theoretical point of view may well want to explore the implementation of a particular theory in a computational system because of the great increase in rigor and precision that such a formulation requires. For this purpose, the virtue of a computer is that it knows nothing other than what it has been told, and so when one reaches a point at which a computational procedure operates correctly, it is reasonably certain that all of the underlying assumptions and subprocedures involved in the description have indeed been made fully explicit. Theoretical discussion in non-computational terms generally proceeds without such constraints, with the result that a certain amount of handwaving as regards the 'less central' issues involved in an analysis is usually taken to be acceptable, and the promissory notes thereby issued are rarely called in. The requirements of specifying a computation, however, do not allow the theoretician to live on this sort of credit.

Perhaps a more interesting reason of principle for pursuing computational morphology is the possibility it offers of saying something serious and testable about linguistic processing. Linguists usually preface theoretical accounts with a disclaimer that these relate to competence (or the structure of the knowledge which we attribute to a speaker), rather than to performance (or the way that knowledge is actually put to use). This is surely a defensible, even essential idealization in identifying a coherent domain of study for an emerging science; but the question of specifying the relation between a grammar of competence and its use in a model of performance has only been postponed by this move, not avoided altogether.

Now unlike a grammar that simply specifies the properties of forms in a language, a computational system actually exhibits a sort of 'behavior': when presented with an input for analysis, it eventually emits some information after pursuing some determinate procedure in real time. The procedure in question is of course founded on some sort of rules that can be taken to specify the structure of the system's 'knowledge.' Insofar as we can establish a reasonable correspondence between the system's properties and actual speaker behavior, we can claim to have developed (at least part of) an account of this aspect of linguistic performance. Furthermore, to the extent to which the structure of the system's 'knowledge' can be based on the principles of linguistic theory, we have validated the notion that knowledge of this form could indeed underlie such performance.

The advantage of morphology for such a demonstration is due to the existence of a vast literature in psychology and cognitive science that deals with the fine structure of human behavior in the performance of much the same task a computational system is engaged in: recognizing and retrieving words and recovering the information they bear. Lexical access and lexical
Morphology as a computational problem

decision tasks are a standard paradigm in psychology, and a great deal is known about how words of various types are recognized.\(^2\) As a result, the implicit claims about performance made by a computational system are probably more significantly testable in the domain of morphology than elsewhere in the study of natural language. Computational morphology thus offers us a chance, at least in principle, to determine whether or not the contrasts of (at least part of) linguistic theory are appropriate as a description of human linguistic behavior.

In the present work, of course, our interest in morphology as a parsing problem is clearly of this second, ‘scientific,’ sort, and we will have little to say below about questions of practical efficiency. We do not mean thereby to disparage work with primarily practical (as opposed to theoretical) goals; but on the other hand, the theoretician should realize that the issues of explicitness and real-time implementation that arise in the computational domain are quite essential to the ultimate validity of frameworks that purport to offer a full understanding of the structure of speakers’ knowledge of their languages.

14.2 Approaches to computational morphology

At least in systems for syntactic analysis, the problem of analyzing the structure of words computationally in Natural Language Processing (NLP) has traditionally been solved by ‘throwing silicon at it.’ If one simply lists all of the words that might be encountered (possibly abstracting away from a limited number of affixes which are stripped off in a preliminary step), together with an indication of their relevant properties, the analysis can get on with the other sorts of task to which “real” NLP systems are dedicated (syntactic parsing, textual searches, etc.). The practicality of this approach, however, is in large part an artifact of the properties of English, the language to which by far the majority of NLP work has been devoted. Since English has very little inflectional morphology, and its derivational morphology is often associated with lexical idiosyncrasy, the ratio of possible word forms encountered in text to necessarily listed lexical items is comparatively low.

Even in languages like English, it is extremely unlikely that all of the words we encounter in reasonably natural text will appear in our dictionary, due to the productivity of processes like compound formation. This is even truer in languages like German. When one attempts to generalize the listing technique to languages with richer morphology, however, it becomes clear that it is both

\(^2\) See Emmorey 1987 for a review of much of this material.
costly and linguistically inadequate. In languages like Finnish or Georgian, each lexical verb may have literally thousands of distinct surface forms, differing in inflectional properties but otherwise the same vocabulary element. Of course, this does not by itself make it impossible to list all of the forms: the numbers involved are after all finite, if large, and the price of memory seems to come down every year. Nonetheless, it seems wasteful to devote such vast resources to lexical listing, given the considerable degree of predictability of most surface word forms in such cases.

More importantly, perhaps, the word space of a language typically shows quite a high degree of structure, and insofar as its dimensions are determined by linguistically significant regularities we ought to be able to extract the information borne by words on the basis of these regularities rather than simply listing them all. From a theoretical point of view, indeed, we have clearly failed to characterize the structure of the language insofar as this substantial area of regularity is treated implicitly as if every word were equally arbitrary. Although speakers obviously memorize lots of things about words, it is just wrong to claim that a list represents the structure of their knowledge. We can, for example, recognize new inflected forms, and forms of nonsense words, so an account of our processing ability has to accommodate such (potential) use of rule-governed regularities in recovering the information present in a word.

As a first approximation to improving on such a list, we might attempt to look up not just the whole word, but each of its constituent pieces. The usual picture of word structure taught in elementary courses in linguistics suggests that words are made up of smaller pieces strung together — minimal signs or ‘morphemes,’ the atoms both of word form and of word meaning. On that view, we might approach morphological analysis as the problem of chopping words up into their component morphemes so that these (presumably irreducible) elements can be individually looked up in a lexicon. Given the English word misinterpretation, for instance, we might attempt to assign it an analysis in terms of its parts as below:

(1) mis + interpret + ation + s
   “MIS” “INTERPRET” NOM PL

As we have attempted to document in the chapters above (see especially chapter 3), substantial evidence exists that this picture is seriously oversimplified and that the notion of the morpheme impedes the understanding

3 And in the case of Finnish, perhaps involving the attachment of clitic elements. If we construe ‘words’ in the sense of orthographic units delimited by spaces, as is usual in computational systems, such clitics are just that much more ‘morphology’ whose contribution to the analysis of the entire word in this sense must be elucidated.
of morphology rather than helping it, but even if we were to accept it the problem would still be quite non-trivial.

Consider, for example, how we might go about analyzing the Finnish word *karahkoja* "stick (partitive plural)." This form is apparently composed of three elements, which could be assigned the lexical shapes /karahka/"stick," /i/"plural," and /ta/"partitive." The concatenation of these elements is related to the surface form by the operation of several phonological rules of Finnish, as in (2):

\[
\begin{align*}
\text{/karahka+i+ta/} & \quad \text{"stick" + "plural" + "partitive"} \\
\text{karahko+i+ta} & \quad (a \rightarrow o \text{ before } i) \\
\text{karahko+i+a} & \quad (t \rightarrow 0 \text{ after a weak syllable before a short vowel}) \\
\text{[karahkoja]} & \quad \text{(glide formation)}
\end{align*}
\]

As is apparent, none of the components of this form (whose shape is justified by the phonology of the language and their appearance in other words) appears unaltered in its surface shape, due to the effects of the phonology. Before they can be looked up in a dictionary of morphemes, then, it would be necessary to compensate for these obscuring influences. The recognition of this problem has driven most subsequent work in computational morphology, which might as a result better be called 'computational phonology.' We survey below three attempts to come to terms with these issues.

14.2.1 Kay's 'chart parsing' approach

The most straightforward way to resolve this difficulty would seem to be simply to 'undo' the phonological rules: applying them in reverse to the surface form, we should arrive back at the underlying shape. From there, in turn, we can attempt to recover the divisions between units by looking in the lexicon to see how the form can be exhaustively covered by lexical items (each representing one morpheme). This sort of approach can be called 'bottom up,' since it starts exclusively from the given form and attempts to find a way of grouping its parts into larger structures.

The approach just outlined was proposed by Kay (1977) in one of the first works to take morphology seriously as a parsing problem. Kay proposes that the procedure for analyzing words is essentially as in (3):

\[
\begin{align*}
\text{a. Given the surface form, first 'undo' the phonology by effectively inverting the rules. This process does not in general yield a unique result (i.e., the same surface form can have more than one possible underlying source with regard to the phonology), so it is necessary to compile a list of the possible representations that could underlie the given form.}
\end{align*}
\]

* See Keyser and Kiparsky 1984 for discussion.
b. For each of these phonologically possible underlying representations, try to find a set of morphologically compatible lexical elements that can be concatenated in accord with the 'morphotactics' of the language to yield this form. Each set meeting these conditions is a potential analysis of the form.

c. For each such phonologically possible analysis, what is to be returned as the result of parsing is a list giving the "content" of each of its successive morphological constituents.

This description became (schematically, at least) the standard assumption about how to do morphological processing, and (at least until quite recently) had the status more of a definition of the problem than a hypothesis about how to solve it. Unfortunately, each step in this procedure presents significant problems when we try to generalize it to a full range of languages.

First, with respect to the assumption in (3a), the notion that the system can as it were look through the wrong end of the phonological telescope and see a morphologically analyzable underlying form has several sorts of problem. Some of these are quite general, and not limited to Kay's particular formulation of the problem; these will be discussed in section 14.3 below. An important issue that arose immediately in Kay's discussion, however, is the following: the fact that real phonologies can sometimes have a depth of significant rule interaction up to fifteen or so rules can lead to a combinatorial explosion in the number of candidate underlying forms. This is because each such rule introduces a certain amount of indeterminacy and complexity into the relation between underlying and surface form, and these complexities interact multiplicatively.

Rules of insertion and deletion are obvious candidates for such increased complexity. Suppose, for example, that a language has a rule reducing final clusters of whatever length to a single element (as in Sanskrit). This means that every single final consonant is potentially many-ways ambiguous, depending on the entire range of clusters that might underlie it (multiplied by all of the possible sources for these clusters, etc.). Similarly, if a rule inserts the vowel /e/ between the second and third member of a cluster of three consonants, then every occurrence of the sequence /...CCeC.../ must be considered to be ambiguous with regard to the status of its vowel. Since phonological rules are well known to interact sequentially in a significant fashion, the result is geometric growth in the space of possibilities.

There are also problems with the notion of "looking up the pieces of the form in the dictionary," since some of the contributors to the shape of a complex word may not correspond to any distinct, segmentable substring that could be looked up. The canonical form of this problem is presented by 'zero-morphs' – in essence, a name for parts of the content of a word that
are not indicated by any aspect of its form. A number of other ill-behaved indicators of morphological structure were well catalogued in structuralist work such as Hockett 1947, though little was done with this zoo beyond an attempt to find all of the animals in it and give them names. In section 14.3 below, we will repeat some of the problematic morphological types already discussed (in chapter 3 above) with particular reference to the difficulties they pose for the step in a computational analysis represented by (3b).

There are even problems with step (3c), the notion of returning a list of the glosses of the component pieces as the 'analysis' of the form. For example, it is clearly insufficient to return simply a linear string of glosses for the constituent 'morphemes' in a complex form, since the relative scope of these elements can be an important part of its analysis. Consider the two possible English words uninfectable and disinfectable, for example. Each of these might be glossed as something like “NEG-INFECT-ABLE,” but this would give no indication of the difference between the meanings “not capable of being infected” and “capable of having an infection removed.” This matter of relative scope corresponds to the internal structure of a Phrase-Marker-like representation on a theory employing morphemes and morphotactic rules for morphological description; or to the internal structure of a derivation, on a rule-based account like the one presented in this work. As discussed in chapter 10 above, there are reasons to prefer the latter account, but regardless of this choice, it is clear that the morphological parse of a complex word must be more than a sequence of glosses for its components. Other difficulties for the step in (3c) will be discussed in section 14.3.

While it appears to be indicated directly as a matter of simple common sense, Kay's approach was never in fact developed for any language with a significant degree of phonological complexity, as a result of a wide range of difficulties (and in particular the problem of an apparently intractable growth in problem size due to indeterminacies introduced by the phonology). Subsequent efforts have been devoted to systems based on somewhat different architectures that attempt to eliminate these problems.

14.2.2 Hankamer's 'keçi' system
An alternative to Kay's bottom-up approach was developed by Jorge Hankamer for purposes which were originally purely practical. In entering a large corpus of Turkish text into a computer, Hankamer wanted to be able to check typographical accuracy. Naturally, this cannot be completely automated, but a good first approximation would be a check that each word entered was in fact a possible word of Turkish. Given the extensive morphological apparatus of the language, however, this clearly could not be done by any sort of exhaustive listing: rather, Hankamer's goal was to check
14.2 Approaches to computational morphology

acceptability by attempting to recognize each word. This clearly leads directly to the construction of a morphological parsing procedure.

The procedure Hankamer developed is based on a representation of the morphological system of Turkish (its 'morphotactics') in the form of a finite-state machine. Without going into details, this representation relies on the fact that, at any point in the analysis, the possibilities for the identity of the next piece of material in a word are severely constrained by the material that has already been identified. Nominal suffixes only go on nominal stems, for example, and the relative order of different suffixes is narrowly limited.

Hankamer's procedure exploits this as follows. The parse starts at the left edge of the word, since Turkish is an exclusively suffixing language and the lexical root is always found in this position. An attempt is made to identify as much as possible of the word with some lexical stem. Once a stem is found, and assuming that it does not exhaust the word, the finite-state machine representing the morphology is consulted to see what material could come next. Given the language's system, the number of following morphemes is quite limited; each of these is tried in succession, by attaching it to the stem and then applying the phonological rules of the language to the result. Insofar as the result is consistent with the form being analyzed, this is taken as confirming the possibility that the element just added might be part of the parse. Once again, if the word has been exhausted (and the finite-state machine is in a possible final state), the accumulated parse is reported as a result; otherwise, the next step in the finite-state machine is tried and the process continues to completion (or failure). At any point, when none of the morphologically acceptable possibilities are confirmed, the system backtracks to the first previous choice point and attempts an alternative path from there. If there is no such point (or no such path), a failure is reported.

From a linguist's point of view, this procedure is extremely interesting because it allows the phonology to be represented in exactly the form commonly assumed in theoretical accounts: as a system of rules that convert underlying forms into surface forms. If some such model of linguistic performance were confirmed, the relation between the sort of linguistic knowledge that seems theoretically motivated and the implementation of that knowledge would be quite direct. Furthermore, since the system operates in a completely determinate fashion in a top-to-bottom direction, there is no combinatorial problem deriving from a multiplicative interaction of alternatives as in Kay's proposal. Hankamer's system also operates very efficiently, and so it would appear to present a satisfying resolution of the parsing problem in morphology.

5 See Hankamer 1986 for description and discussion.
Unfortunately for the generality of this conclusion, the efficient operation of Hankamer's parser is due in essential ways to some accidental properties of Turkish that do not allow its direct extension to a full range of other languages. First of all, since Turkish is an exclusively suffixing language, the lexical root can always be found reliably at the left edge of the word. Obviously the same procedure could be carried out from right to left instead of left to right for a language that was exclusively prefixing (if there are any such languages), but for languages with non-trivial amounts of both prefixing and suffixing, the problem of finding a starting point for the analysis becomes correspondingly complicated.

Another somewhat adventitious property of Turkish is the fact that in this language, all of the phonological effects that the parser needs to take into account operate from left to right. As a result, the phonological admissibility of the material under analysis up to any given point can be checked exhaustively without taking into account any material not yet analyzed. Since most phonologies of any real complexity have anticipatory (right-to-left) effects as well as perseverative (left-to-right) ones, however, the extension of this mechanism to a representative sample of the languages of the world would require some sort of procedure to keep track of potential effects that can be accepted if and only if their facilitating context arises in material that is analyzed later. This, in turn, contains the seeds of a combinatorial problem when anticipatory effects are substantial.

Further, the phonological effect any Turkish affix has on the material following it is always predictable from its surface form (i.e., neither underlying nor intermediate representations of material already analyzed need to be referred to). This effect is also utilized by Hankamer's parsing strategy, although in many languages representations other than surface forms are necessarily referred to, to state the scope of phonological generalizations. The modifications necessary to admit the effects of the underlying form of one suffix on another are minimal, but the incorporation of the effects of intermediate levels of representation require essentially the recapitulation of the entire derivation at each step of the parse.

Finally, Turkish (being very nearly the canonical form of an agglutinating language) has a morphology involving exclusively overt, segmentable affixes which can in principle be looked up in a list. Insofar as a language makes use of non-affixal changes (such as the 'ill-behaved' processes discussed below in section 14.3), some further mechanisms must be employed to recover the information carried by such operations. This is a problem that is in no way particular to Hankamer's approach: as noted above, virtually all existing parsing strategies rely on the notion that once the phonology proper has been undone, the resulting representation will carry morphological information in
the form of an exhaustive segmentation into items on a list of the language's morphemes. Nonetheless, the language-particular absence of such non-segmentable morphology in Turkish contributes to the simplicity of Hankamer's parsing strategy.

All of these points, taken together, indicate that the top-down strategy pursued by Hankamer does not generalize directly to a full range of languages without significant revision. It should be emphasized that this criticism is largely irrelevant in the context of a system designed for a practical purpose: if one wants a system that will yield analyses of complex Turkish word forms, this technique exploits the properties of the language fully so as to yield a highly efficient procedure for doing this. If the primary interest is in a parsing procedure that can serve as a general model for the morphological structure of natural languages, however, there is a good deal of work still to be done, although the system has a number of very interesting features from a linguistic point of view as well as a practical one.

### 14.2.3 The KIMMO system

A somewhat different approach to the phonology arose out of unpublished work by Ron Kaplan and Martin Kay. They argued (in unpublished work presented as Kaplan and Kay 1981) that the effects of a phonological rule can always be represented by the behaviour of a finite-state transducer. The same contention was also argued independently and in more detail by Johnson (1972), whose work was not known to Kaplan and Kay. Importantly, Kaplan and Kay observed that a cascade of such transducers, representing a set of ordered rules, can always be represented as a single transducer. In consequence, since finite state transducers are presumed to be quite tractable computationally, it would seem that the phonology of any natural language has a representation in the form of one such machine.

A problem, however, is that (assuming the validity of the transducer representation of each rule), the size of the resulting merged transducer can grow exponentially as the set of rules grows. Essentially, when two cascaded transducers have a significant amount of interaction, the result of merging them is a machine whose size (in the worst case) is the product of the sizes

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As Johnson makes clear, the claim at issue is an empirical one. That is, the formalism available for the expression of phonological rules surely allows for processes that are not expressible as finite-state transducers but Johnson's contention was that all known processes in natural languages can in fact be described in a way consistent with this restriction. Especially in light of the enriched notions of representation that have become available in subsequent theorizing about phonological structure, and the lack of concomitant theorizing about the exact range of rules operating on these representations, the conclusions of Kaplan and Kay, and of Johnson, may need to be re-examined from time to time.
of the two simple transducers. Again, as in the pure bottom-up approach, a combinatorial explosion results (or at least could result) when a language displays significant depth of ordering. The size of the resulting transducer grows geometrically in a way that faithfully reflects the growth of the range of possible underlying forms, and without reducing the size of the set of possibilities that must be considered by the system. Most of these phonologically possible forms do not correspond to any possibilities offered by the lexicon and morphology of a language, but it is not possible to exclude the impossible cases in advance. As a result of the recognition of this fact, Kaplan and Kay's observation about the relation between rules and transducers was relegated to obscurity.

In later work, however, Koskenniemi (1983) observed that in fact many rules are independent of one another within a given grammar, and when this is the case it is possible to model them with transducers that operate in parallel rather than in a cascade. The resulting system has a size equal to the sum, rather than the product of the sizes of the individual transducers. Koskenniemi proposed that we take this as the general case, and that we deal with violations of it in other parts of the grammar (basically, by representing some parts of some alternations directly in the lexicon rather than as rule governed). This system was further developed by Karttunen (1983 and later work), and has resulted in a very efficiently implemented parser for the morphology of Finnish.

The procedure followed by the KIMMO parser is centered on a representation of the phonology which compares a candidate pair of underlying and surface representations to see if their relation is of the sort sanctioned by the language. This they do by stepping a pair of read-heads simultaneously along the two strings, seeing whether the individual segment-to-segment correspondences are consistent with the set of finite-state transducers (operating in parallel).

Naturally, a fundamental question concerns the way in which the pair of strings to be compared is constructed. The system is intended to be essentially neutral between the task of recognizing a form and that of generating it. When analyzing a word presented to it, the KIMMO parser builds up a candidate underlying form that will satisfy the phonology. It does this by starting at the left edge, looking for a stem, trying the morphemes that are in the continuation class of this stem, then adding those that are in the continuation class of the last morpheme added, etc., until a form is arrived at whose relation to the given word is well formed and which exhausts the surface word. The resulting string of morphemes is the analysis. On the other hand, when the system is generating a surface form from an underlying representation, it takes the presented underlying string of morphological units (the analysis) as given, and tries (making use of a list of surface segments
that could correspond to any given underlying segment) to construct a surface string that will meet the requirements of the phonology. While analysis and generation employ somewhat different strategies, the role of the phonology is essentially bidirectional: it just checks proposed correspondences, rather than creating one form from the other.

The appeal of this (the "lure of the finite state") is that finite-state transducers are rather restricted in mathematical power, and should be computationally very efficient. The observed behavior of the KIMMO system is certainly consistent with this. However, Barton has shown (see Barton, Berwick, and Ristad 1987) that grammars of the class conforming to the requirements of KIMMO-type systems are not guaranteed efficient parsability. In particular, if the grammar contains either unbounded right-context effects or nulls, the parsing problem for such a system is $\mathcal{NP}$-complete (i.e., potentially very hard). Right-context effects and nulls are clearly necessities for linguistically 'clean' accounts of the phonologies of some languages, even though, for example, left-context effects are more common than (non-local) right-context effects. Of course, this result does not mean that any particular grammar is going to become intractable for a KIMMO system, and if our goals are practical ones, an efficient system of this kind may be just what we want. If we want to pursue the problem as a form of (general) morphological theory, however, Barton's result is potentially disquieting. It has been suggested in the literature that natural languages may well actually be simpler than assumed in Barton's proof, but if so the architecture of the KIMMO system does not suggest why that might be the case, and in fact (if taken as a theory) suggests it ought not to be.

Aside from the issue of computational tractability, the KIMMO design raises another issue. Since the transducers all run in parallel, comparing underlying and surface form, intermediate levels of representation are in principle unavailable. This claim that only underlying and surface representations are relevant to phonological conditioning is falsified by cases like the famous final truncations in the Australian language Lardil.\footnote{See Hale 1973a for the facts on which subsequent discussion has been based. Some conclusions about the import of this example and others for the kind of question under discussion here can be found in Kenstowicz and Kisseberth 1979: ch. 8.} In (4) we give the derivation of the Lardil word [muŋkumu] "wooden axe" from underlying /muŋkumunŋku/. Crucially, the changes involved at each stage in this derivation involve deletions that occur only at the end of a word. While the /u/ deleted in the first step is word-final underlyingly, and the /ŋ/ deleted in the last step would be final in the surface form, the segment /k/ deleted in the second step is only word-final at an intermediate stage of the derivation.
The KIMMO system requires that every phonological rule express a transparent, surface-true well-formedness condition on the relation between underlying and surface forms. This is the kind of condition that is associated with a phonological theory like that of ‘Natural Generative Phonology’ (see Hooper 1976), and a substantial majority of phonologists would probably agree that the discussion of that position in the 1970s showed it to be seriously inadequate as an account of phonological structure. Without detailing here the objections that were raised to Natural Generative Phonology, insofar as one takes those objections seriously, they have to count as objections in principle against the KIMMO approach to morphological parsing too.

Where rules interact interestingly, their effects are not generally separable within such a system, which relates underlying and surface forms directly. Again, for practical purposes this may not be significant: alternations that do not conform to the limitations imposed by this approach to phonology can just be listed in the lexicon as if they were suppletive. Such listing is in fact rather extensive in the KIMMO lexicons for languages like Finnish with complex phonologies. Although this amounts to an implicit claim that much of the well-studied phonology of the language is not in fact systematic (since it cannot be represented as a transparent, surface-true generalization and thus not as one of the parallel transducers of the system), this has no observable consequence for the extent to which the system can produce the correct forms. It is only because such a listing approach must be rejected as theoretically unsatisfactory that it presents a problem.

On the other hand, the KIMMO system makes both the surface and the underlying form available at all points, allowing a kind of global reference (“[a] can correspond to /b/ if it precedes a [c] that is underlyingly a /d/”) which is excluded by the purely markovian character of standard, sequentially applied rules. The possible linguistic consequences and motivations of this step have not yet been explored.

In sum, the KIMMO approach to morphological analysis has much to recommend it from a computational point of view, at least for those languages for which it has been tried – as with Hankamer’s approach, this is largely limited to languages that are exclusively suffixing. From the point of view of linguistic theory, however, it appears to rest essentially on assumptions that are either discredited or unclear in import. We might even go so far as to say that, if we had reason to believe that human morphological analysis utilizes a procedure that is substantially similar to that of the KIMMO system, this would suggest that much linguistic theory is misguided. To the extent we accept the results of that theory as giving an appropriate characterization of
linguistic knowledge, in contrast, we have reason to look for an alternative to the KIMMO procedure.

14.3 Some general problems

Our result, to this point, is largely negative. It appears that the best ways to build a theoretically satisfying account of linguistic structure into a parsing procedure lead (in the general case) to computational intractability; but that the only ways to ensure a manageable computation involve restricting in unacceptable ways our claims about how much of a speaker's knowledge of a language is systematic. Our remarks in section 14.4 below concerning paths toward the resolution of this conflict will necessarily be rather programmatic in nature, but before we address these other possibilities, we discuss some further issues concerning morphological parsing that apply rather generally to the approaches that have been tried to date.

While a number of approaches to the architecture of morphological parsing systems have been examined (of which those considered in the preceding sections are only a sample), the overall conceptual outline of the task has quite generally been taken to be essentially that proposed by Kay, as in (3): first undo the phonology, then parse the resulting string into morphemes, and return a string of glosses of these morphemes as the analysis. We return now to a range of difficulties that are associated with this assessment of the substance of the parsing problem in morphology.

14.3.1 'Undoing' the phonology

All of the approaches to morphological parsing surveyed in the preceding sections assume that the problem of undoing the phonology and that of analyzing the morphology can be strictly separated. In fact, all of them devote more attention to the problem of undoing the phonology than to the structure of the morphological system itself, assuming that the latter can be represented as something like a finite-state machine describing the admissible concatenations of underlying forms from a lexicon of morphemes. However, there are reasons to believe that this assumption is inadequate. In particular, we saw in chapter 9 above that instead of composing a form morphologically and then submitting it as a whole to the phonology, it is necessary to develop the morphology and the phonology of complex forms in some languages in a more complex, interleaved fashion.

A simple example of this kind can be provided from Javanese (see Dudas 1974). This language has a morphological process that forms the 'elative' (a sort of superlative) of Adjectives by raising the last vowel of the stem to a
[+ High] vowel of the same rounding. This rule interacts with another rule of the language, by which underlying /a/ in final open syllables is rounded to [o]. What is important is that the product of the Elative formation rule when applied to stems whose last vowel is /a/ depends on the applicability of the /a/ \rightarrow [o] rule:

(5) /kamba/ /gampan/ lexical form
/kambo/ — final /a/ \rightarrow [o]
[kambu] [gampin] Elative formation

What is important in this example is the fact that in order to obtain the right result, it is necessary to apply the (phonological) rule rounding final /a/ before the rule forming the Elative, since /a/s that have been rounded raise to [u] in the Elative while those that have not raise to [i]. Now both of these rules are individually possible to ‘undo’ – but crucially, the morphological formation must be undone before the phonological rule (starting from the surface form). Thus, the strategy of recovering a phonological underlying form in full before attacking the morphological analysis cannot deal adequately with this case.

A similar conclusion is entailed in a more systematic and principled way by the proposal (associated particularly with Lexical Phonology: see Kiparsky 1982a; Kaisse and Shaw 1985) that the morphology and the phonology are inter-related in a cyclic fashion. If some such picture is correct, as suggested in chapter 9, it follows of necessity that the undoing of the two in a parsing procedure must also proceed hand in hand, rather than being separated as on the models we have considered thus far. Examples of genuinely cyclic application pose problems of the same basic sort as that presented by the Javanese example for such positions. Consider the following Dakota forms (from Kaisse and Shaw 1985):

(6) /kax/ kav-a “make” kax-kav-a “make lots”
/kos/ koz-a “wave” kos-koz-a “wave repeatedly”
/i-kax-e/ ičave “tool”
/ni-kos/ ničoza “waves at you”
/ki-kax-kax/ kičaxčava “made it for her” (*kičaxkaya)
/ki-kos-kos/ kičosčoza “waved to her” (*kičoskoza)

Here the phonological rule by which /... ik.../ \rightarrow [... ič...] has to follow the prefixation of /i-/ or /ki-/ to the root, but precede the morphological rule of reduplication.

The general point is that our current understanding of the interaction of morphology and phonology suggests that this is best interpreted in terms of a cycle, whereby the (lexical) phonology applies separately to the output of each stage of morphological development as discussed in chapter 9 above. If this is the case, it will be impossible (in the general case) to undo all of the
phonology before attacking the morphological analysis. The conclusion to be drawn from this observation is that the analysis of morphology and phonology must proceed hand in hand in an adequate parsing system that hopes to extract all of the linguistically governed regularities of word structure. This is not unnatural in a system that operates in what is basically an analysis-by-synthesis mode (such as Hankamer’s parser, appropriately modified), but it is hard to see how to incorporate such an approach in a true bottom-up design.

14.3.2 Finding the ‘morphemes’

The approaches considered thus far all share the standard working assumption of ‘classical’ structuralist morphology, which consists in the claim that when two (or more) words are ‘morphologically related’ this relation can always be expressed as a matter of their ‘sharing some morpheme(s)’ (perhaps modulo the effects of the phonology). But as we have emphasized repeatedly in this work, some morphological relations are non-affixal, and in these cases there will be no segmentable morpheme for the forms to share. The standard difficulties for morpheme-based morphological theory that were surveyed in chapter 3 thus reappear as difficulties for computational analyses of word structure that treat the morphological analysis per se as a matter of segmenting a phonologically analyzed string into lexical units.

One form of this problem is presented by infixes, as in Sundanese nadalahar “to eat several,” from nadahar “to eat,” and by circumfixes, such as German gefunden. Here the ‘lexical’ units do not correspond to continuous strings; the greater the distance covered by such a dependency, the more problematic it becomes for the “lexical lookup” function.

More serious formally, perhaps, are examples involving morphological material that does not lend itself at all to analysis by lexical lookup of some constant segmentable substring of a form. Reduplication, for example, involves an ‘affix’ whose form varies as a function of its environment, rather than corresponding to a lexically listable constant. Even if it is possible to give an analysis of reduplicative morphology in terms of an ‘affix’ with rather abstract prosodic structure as its content (a claim which has by no means been established in the general case: see Steriade 1988), this is unlikely to be of immediate benefit to computational analyses which deal in letter strings.

It should also be pointed out that while much reduplication is of some limited prosodic unit (such as all or part of a syllable), reduplication may also involve the copying of an entire form, as in the Madurese form sakolaʔan-sakolaʔan “schools,” from sakolaʔan “school.” Culy 1985 points to such a construction in Bambara, where the unbounded character of the structure that is reduplicated represents, from the point of view of recognition, a case that requires at least the power of context-sensitive parsing mechanisms.
Ablaut, Umlaut, and other types of 'mutation' also pose obvious problems for a morpheme-based parsing strategy. What is relevant to the analysis of *sit* is the relation it bears to *sit*, a relation which is not naturally expressed in terms of shared (vs. unshared) substrings. That is, there is no plausible way to find /sit/ and *past* as substrings of a form that phonologically underlies [sæt]. In English, it could be argued that these examples are lexically sporadic and idiosyncratic, and that it is thus not obviously inappropriate to treat them by lexical listing as required in, for example, the KIMMO system. Where such mutations are more systematic, however, as in, for example, Icelandic, such an account is linguistically unsatisfactory, and they pose clear problems for parsing.

We argued in chapter 3 that in at least a few cases, morphological categories are signalled by metathesis (switching the order, but not the identity, of phonological elements). Thus, in the Salish language Saanich, λʾpɔx “scatter” and λʾɔpx “scattering” are related in this way. Again, there is no segmental content corresponding to the category glossed here as “-ing.” Similar problems are posed by the existence of morphologically motivated truncation. We have already seen several such examples in previous chapters; another subtraction rule is found in Upper Hessian dialects of German (Schirmunski 1962), as illustrated in (7).

(7)  

<table>
<thead>
<tr>
<th></th>
<th>Singular</th>
<th>Plural</th>
</tr>
</thead>
<tbody>
<tr>
<td>hond</td>
<td>hon</td>
<td>“dog”</td>
</tr>
<tr>
<td>r̥ŋk</td>
<td>rŋ</td>
<td>“ring”</td>
</tr>
<tr>
<td>bãrk</td>
<td>bãr</td>
<td>“mountain”</td>
</tr>
<tr>
<td>schuk</td>
<td>schu:</td>
<td>“shoe”</td>
</tr>
</tbody>
</table>

Obviously, in these cases there is no ‘morpheme’ to find in the phonological underlying form.

Finally, although the phenomenon has not been much remarked in the theoretical literature, some sorts of morphological relationship have a somewhat non-deterministic character, which we could paraphrase somewhat as “forms A and B may potentially be related to one another if they differ only in such and such a way.” Importantly, such statements may not involve obligatory phonological relations of any sort, but only quasi-systematic correspondences. This state of affairs is extensively documented for Brazilian Portuguese by Lopez (1979); in this language, massive borrowing by Portuguese from its own history has resulted in the co-existence in the same language of related words representing different diachronic developments. For example, the sets in (8) below all surely share a morphological unit:

(8) a. amigo “friend”; amical “friendly”; amizade “friendship”  
   b. jejum “a fast”; jejunal “of a fast”; jejuar “to fast”
c. dor “pain”; doloroso “painful”
d. juiz “judge”; juízo “judgment”; judicial “of a judge”
e. lovo “wolf”; lupino “of wolves”
f. moeda “money”; monetario “monetary”
g. articulo or artigo “article”

Lopez shows that each of these cases has the same character: a formal relationship (e.g. [g]/[k]/[z], [u]/[un]/[u], [V1V]/[VV] etc.) that does not correspond to a phonological regularity of the present language, but rather to the difference between forms that have undergone some historical change and semantically related forms from a stage of the language to which that change had not (yet) applied. The set of such “correspondences” that have some systematic status within the language can be specified, and so they should not be treated as purely suppletive. Since they do not correspond to rules of the phonology, however, the relations instantiated in (8) must be described as an aspect of the notion ‘morphologically related words’ (in Portuguese). Without attempting to document this situation further within the space of this chapter, it is clear that both it and the much better known case of non-affixal morphology motivate a more general notion of what it means for words to be morphologically related than is yielded by the usual exhaustive partitioning of words into morphemes.

14.3.3 The output from the analysis process
Another issue in the design of a morphological parser which has gone largely without discussion is the question of just what kind of result such a parser should return as an “analysis.” Of course, if words are exhaustively divisible into morphemes, it might seem obvious that an analysis ought to consist of an indication of just what morphemes are present in a given word. That is the account implied by a parser that analyzes a word by indicating where one morpheme stops and the next one begins, and what meaning is associated with each (as virtually all current parsing systems do). We have already seen that such an analysis in the form of a linear sequence of glosses for component morphological constituents must be supplemented by some indication of the structural relations among these constituents; in chapter 10 above, we argued that this should take the form of an indication of the sequence of rules applying within a derivation of the word, rather than a sort of ‘mini Phrase Marker.’ But there are further problems that arise from the assumption that the components of a word’s analysis stand in a one-to-one relation with a set of substrings whose concatenation yields the word in question.

In the context of an analysis that serves the purpose of a syntactic parser, at least, it is possible to argue that this sort of account of word structure is both too strong and too weak. It is too strong in the sense that some
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information will be present in it which we might want to claim is systematically irrelevant to the syntax. In other words, the syntax cares about what categories are actually indicated by a given word (such as case, number, agreement, etc.), but it does not need (or want) information about just how the word indicates them.

For example, a word may contain more formal pieces than there are motivated components of its syntactic and semantic content, when the same aspect of meaning is signalled in more than one place. In Chickasaw akhi'lho "I'm not dancing," for example (compare hilhali "I'm dancing"), four separate aspects of the form indicate the component NEGATIVE of its meaning. In addition, the actual order of the pieces is systematically irrelevant. Thus, it does not matter whether the Subject marker comes at the beginning or the end of the Verb: compare Chickasaw hilhali "I'm dancing" (where the Subject is marked by a suffix) with ishihilha "you're dancing" (where the Subject is marked by a prefix). These forms are identical in the relevant aspects of their syntactic behavior; and more generally, no language appears to treat the actual linear position of markers within a complex form as per se relevant to its syntax or semantics.

On the other hand, the pure morpheme-by-morpheme analysis usually assumed in computational systems is also too weak, in that some information may be systematically conveyed not by material that is present in a word, but rather by what is absent from it. That is, there may be fewer formal pieces than components of content, as in the Georgian form mo-g-klav "I will kill you (sg.)," where no overt piece corresponds to "first-person Subject" (nor is this marked in general with a θ-morpheme).

In general, the relation between components of form and components of content is many-to-many, rather than one-to-one. The general point of these remarks is largely the same as that of chapter 4, in which we developed the notion of a word's Morphosyntactic Representation. On the basis of those considerations, we suggest that instead of a morpheme-by-morpheme gloss, a parser ought really to return the information in (9).

(9) a. An indication of lexical identity (with a pointer to the syntactic and semantic properties of this lexical item); and

b. A Morphosyntactic Representation that shows the inflectional categories conveyed by this word form.

* Of course, this linear position may reflect, for example, sequential position within a derivation of the word, and this may correspond to relative scope. As we have argued in various points above, however, it is the structure of the derivation and not its formal reflex in the shape of the word that is potentially of interest for such purposes.
14.4 Alternatives to existing approaches

As we have seen, this representation may actually involve some local computation of what properties are present on the basis of the formal markers that can be identified.

These and other issues in the theory of morphology have been discussed elsewhere in the present work. The point is to notice that a theoretically well-motivated account of word structure, in the context of an overall view of the relation of morphology to the other parts of a grammar, involves a number of considerations that have not played much of a role in the morphological parsing literature.

14.4 Alternatives to existing approaches

On the basis of the considerations in the preceding sections, we might undertake to modify some one of the existing strategies for parsing morphological structure so as to arrive at an account that satisfies the requirements of current linguistic theory in this domain. But even before attempting to do this, we are confronted by the difficulties raised in section 14.2. Simplifying somewhat, analyses such as those of Hankamer or Kay appear to be founded on a linguistically appropriate formulation of the "knowledge" on which they are based, but to be intractable in computational terms; while the assumptions that yield computationally manageable descriptions\(^9\) in the KIMMO system exclude much that linguists would argue is systematic from the domain of the principled (as opposed to the listed) in such a system. This could well be taken as a rather severe indictment of the claims of linguistic theory as to what kind of structure ought to be attributed to speakers' knowledge of the phonology and morphology of their languages. It might of course simply be the case that descriptions of linguistic competence and of actual processing do not relate directly to one another; but at least \textit{prima facie}, it ought to be unsettling to conclude that knowledge organized in the way linguistic theory appears to indicate seems not to be appropriate as the basis of a computational procedure to analyze the structure of linguistic objects.

If what seems to be the linguistically motivated description is to be incorporated fairly directly into a parser, as for instance in Hankamer's approach, what we might want the procedure to do (at least schematically) is first to find in the lexicon the root (or derived stem) on which the form is

\(^9\) Recall, however, the argument in Barton, Berwick, and Ristad 1987, that even KIMMO systems may not guarantee efficient parsability to the extent that was originally believed.
Morphology as a computational problem

built; and then to explore the paradigmatic space of that lexical item to find
the word under consideration. Let us assume (following the preceding chapters
of this work) that at least insofar as inflectional morphology is concerned,
the dimensions of this space are given by the structure of Morphosyntactic
Representations (MSR) in the language in question. As developed in chapter
4, each such MSR is an indication, in the form of a complex symbol, of the
externally relevant properties of the word that are indicated by its form. The
parser must be given a (language-particular) definition of the well-formed
MSRs associated with words of a given class, together with the system of
morphological and phonological rules of the language that yield surface forms
from their representation as a pair \( \{ \mathcal{L}, \mathcal{M} \} \) consisting of a lexical stem \( \mathcal{L} \)
and a MSR \( \mathcal{M} \). On the basis of that information, the exploration of the
paradigmatic space of an identified lexical item could consist of trying out
various possible MSRs to see which one(s) might yield the word under
consideration from the (previously identified) lexical stem.

On this account of how the problem is to be decomposed, we can note that
the total complexity of the lexicon of a morphologically elaborate language
can be factored into two corresponding components: the number of stems
(or 'basic' lexical items), multiplied by the number of forms in the paradigmatic
space of each. The total set of possible surface words in a language, that is,
may be very large. To analyze a particular word by an unstructured analysis
by synthesis procedure, which would implement the linguistically motivated
rules of the language in a more or less direct way, it would be necessary to
try out vast numbers of alternatives that are not ultimately successful.
Whenever this happens, it will be necessary for the parser to backtrack and
start over again. As a result, the time necessary to perform such an analysis
grows with the complexity of the linguistic system, and not simply with that
of the word being analyzed. Now this seems to be quite unrealistic, as a claim
about psychological processing: speakers of a language such as Finnish, whose
total set of words is much larger as a function of the large paradigmatic space
occupied by each lexical item, do not seem to take correspondingly longer to
recognize individual words than do speakers of morphologically much simpler
languages like English.

This is not a difficulty peculiar to the problem of morphological parsing:
indeed, the standard objection raised to analysis by synthesis proposals for
the recognition of structure in diverse areas is precisely that the large number
of incorrect alternatives that must nonetheless be explored leads to massive
backtracking and a concomitant explosion of the time required for recognition.
The basic problem confronting the proponent of such an architecture is thus
to eliminate this apparent consequence.

One obvious way out of the difficulty would be to explore the set of potential
analyses at any given point in the procedure not one after another, with backtracking, but simultaneously and in parallel. Of course, if the computational resources required for such a step are unacceptably massive, we have simply exchanged an unintuitive result about processing time for an equally unfortunate result about processing space. Perhaps, however, it is possible to decompose the problem in such a way that a more or less manageable number of alternatives is under consideration at any given time; and that as some of these prove untenable, the processing capacity previously devoted to them can be re-allocated to more extensive consideration of the remaining viable hypotheses.

We propose that just such a decomposition is implicit in our formulation of the problem above: first we wish to identify the lexical root, and then once we have found the root(s) that might underlie the word, we want to probe the language's paradigmatic space around each of them. Suppose that the number of lexical bases in a language is of the order of 50,000–100,000 (roughly the size of the concise edition of *The Random House Dictionary*). That number might be taken as the size of the parser's initial hypothesis space, concerning possible roots; but of course for any given word being analyzed, a very quick check would show that the vast majority of those bases could not possibly underlie the word in question. Once a candidate set of bases has been selected, the dimensions of the language's paradigms (assumed to be complex) can be considered; but the number of possible values along any of those dimensions is likely to be fairly small, so that the number of new alternatives generated by considering the range of values for a given dimension will still be small compared to the number of previous hypotheses that can be disconfirmed.

It might be objected that of course a parallel procedure will economize on time, because it involves many more computations during a fixed amount of time than a serial process. This is not the point, however. The procedure just suggested could be expected to achieve computational efficiency not simply by multiplying the resources devoted to the problem, but by exploiting the fact that the systematic structure of a natural language's word stock allows us to explore it in a way that keeps the growth of alternatives tractable in purely local terms. Once the obviously impossible lexical bases are eliminated, most of the computational resources can be immediately re-allocated to exploring the set of words that might be founded on the remaining possibilities. Since the procedure involves no backtracking, many possible paths can be pursued in a non-exclusive fashion. One that fails to be confirmed may have a temporary cost in processing resources, but none in added time.

In the discussion of the complexity of natural language structure given by Barton, Berwick, and Ristad (1987), the possibility of achieving qualitative
improvements in the performance of a system by parallelizing the
computations involved is largely disregarded. Their reasoning is that the effect
of parallelism is simply to multiply the number of calculations possible in a
given amount of time by some constant factor. However, Barton, Berwick,
and Ristad reason that if a 'hard' problem is sufficiently modular in its
structure, with its various dimensions suitably partitioned into individually
manageable, independent subproblems, parallelism could potentially have
more important consequences for its solution. Indeed, it is precisely in the
domain of morphological structure that Barton, Berwick, and Ristad (1987;
ch. 6) suggest that this effect might obtain: they suggest treating morphological
recognition as an instance of simultaneous constraint satisfaction (rather than
as a problem in combinatorial search) as an instance of how to organize a
problem so as to make it amenable to significant parallelization.

Following this insight (though along quite different lines from those pursued
by Barton, Berwick, and Ristad in their discussion of a constraint satisfaction
approach to KIMMO systems), we can identify two problems that the parsing
strategy must solve if it is to recognize words on the basis of a linguistically
satisfying description of the lexicon, morphology, and phonology of the
language. First it must find the lexical base of the word. This procedure is,
as we noted above, comparatively trivial in a language like Turkish, whose
exclusively suffixing nature ensures that the left edge of the root will coincide
with the left edge of the word. If a language has non-trivial amounts both of
prefixation and of suffixation, however, such a result will not be guaranteed,
and we need some richer procedure to ensure that the analysis can get off the
ground without extensive backtracking. Secondly, we must provide a way in
which the paradigmatic spaces of candidate lexical roots can be examined
without requiring backtracking that expands exponentially as a function of
the number of dimensions of this space.

When the problem is viewed in this way, the data objects over which the
computation takes place are individual candidate hypotheses about the word's
analysis that remain viable at any given point. Each such hypothesis has two
aspects, as in (10).

(10)  a. A proposed (perhaps only partial) representation as an abstract \{S, M\}
pair as described above; and
b. A (perhaps partial) representation of the surface form that would
correspond to this pair.

There are two sorts of operation that can be performed in parallel across the
entire set of such hypotheses, as in (11).

(11)  a. Candidate \{S, M\} pairs can be sent through the morphological and
phonological rules of the language to derive their surface form (to the
extent possible at a given point in the development of hypotheses); and
b. Candidate surface forms can be compared with the actual word under analysis to see if they are grossly compatible with it.

The comparison referred to in (11b) above can be performed quickly and efficiently by a set of finite-state transducers operating in parallel, specifying in a language-particular fashion the range of deviations between underlying and surface forms. Such a computation is similar to what is involved in determining the 'distance' of an orthographic string from the attested lexicon of a language in familiar spelling checking programs. This specification is intended only as a rough pruning procedure for hypotheses: hypotheses that lead to forms whose distance from the form being analyzed is too great can be pruned from further consideration. This is not intended to serve as a systematic confirmation of the correctness of any hypothesis, and it can therefore operate in a 'permissive' fashion, without checking for the validation of contextual effects which could lead to backtracking.

The strategy to be followed in pursuing the analysis of a given word is as follows. We assume the machine on which the analysis is being performed consists of a large number of interconnected processors — a number of the order of the basic vocabulary stock of the language, though this might well be reduced substantially. When an analysis is initiated, the control program assigns one processor to each lexical base, allowing that processor simply to assume that its base is the correct one for the form in question. The correctness of this assumption is then checked locally by applying the comparison procedure sketched above.

Insofar as a given hypothesis (at any stage of the procedure, including this initial, lexical search step) is shown not to be viable, the processing resources allocated to it can be freed for other uses. This corresponds to the backtracking step in a serial-search procedure, but in this context simply means that some of the parallel searches are to be abandoned in favor of others. For those hypotheses still in contention, processors are allocated to explore individually the various possibilities within the (remaining portions of each one's) paradigm. Trying a hypothesis means applying those morphological rules (together with their phonological consequences) that would follow from it, and checking (again, permissively) to see if the result might be consistent with the form being analyzed. When all of the paradigmatic dimensions have been exhaustively searched for all of the roots that remain viable, the remaining hypotheses can be run through the rules to see which (if any) match the form in question exactly. The resulting \( \{ S, M \} \) pair(s) can be considered the analysis (or analyses) returned by the parser.

Obviously, many of the details of this procedure remain to be developed at this point, though it appears that at least for the range of structures that occur in inflectional morphology, the dimensions of the problem do not exceed
the resources available, and lend themselves directly to a constraint-
satisfaction approach to recognition. If this is indeed the case, a number of
important conclusions would follow from that fact. For one, such a parser
should be able to operate in something like linear time as a function of word
length. This would be in accord with the psychological literature on
word-recognition behavior, as far as that literature goes. Given that at least
a gross match might be obtained between the behavior of the parser and that
of actual human subjects, we could begin to redeem the promises made at
the beginning of this chapter to confront an explicit model of human linguistic
performance (in at least this one area) with the observable facts of natural-
language processing.

Another area in which this parsing strategy seems likely to yield results
that can be compared with observed data in the psychological literature is in
the area of lexical priming. It has been noted in a great many experiments
that when a word is recognized, a number of other words related in various
ways to it are simultaneously 'activated' to a greater or a lesser degree. A
parallel search strategy such as that outlined above necessarily replicates this
property, since a number of possible hypotheses are always being entertained
simultaneously at any given time. By examining the class of words that appear
to be related in terms of lexical-priming experiments, we could hope to refine
the model's picture of the course by which the hypothesis space is structured
and progressively narrowed.

Furthermore, the parser in question could be coupled with a syntactic
analysis procedure, proceeding in parallel with it in such a way that the two
modules of the overall analysis could dynamically take into account
information exchanged with one another. Thus, the syntactic analysis of one
part of a structure constrains the class of viable morphological hypotheses
at some other point to those consistent with (at least one of) the evolving
syntactic possibilities; and the range of candidate analyses still in contention
for particular words can be used in turn to constrain the syntactic side of the
process. For instance, when the properties of the Subject NP are identified
with sufficient precision, these limit the agreement properties of the main Verb
of the clause; and when a Verb is identified as agreeing with a NP having
certain properties, only syntactic structures satisfying this condition need be
contemplated. Since each of the components of the analysis process — the
syntax and the morphology — are engaged in a process of continued
hypothesis formation and refinement, they should be able to make use of one
another in speeding the process of eliminating impossible or inconsistent
analyses.

Finally, and perhaps most importantly, the representation of the grammar
in the parser can have all of the characteristics that appear to be motivated
on theoretical grounds, as described in previous chapters of the present work: in particular, it can be based on a representation of morphological structure as a set of Word Formation Rules rather than as a dictionary of morphemes. The rules of the morphology and of the phonology can encompass regularities of some abstractness, as required by linguistic theory, but precluded by parsing strategies tied too close to direct correspondences between underlying and surface form, such as KIMMO. If such a parser can be developed as planned above, it would thus constitute an explicit model of linguistic performance (at least with respect to word recognition) which incorporates in a rather direct form an account of the structure of linguistic knowledge that corresponds to the linguist's notion of competence.

14.5 Conclusion

In earlier sections, we surveyed a number of approaches that have been taken in the literature to the problem of parsing morphological structure, and noted some areas in which they appear to be deficient. The conclusion that seems to follow is that the usual sorts of bottom-up analysis fail in general in this domain, and some sort of strategy that incorporates a system of morphological rules and a system of phonological rules, operating in a cyclic fashion, must be involved in our general capacity to recover the information present in words.

The preceding discussion has dealt with the parsing of 'morphology' as a unitary notion. It is probably not the case, however, that a single, monolithic system is responsible for morphology as a whole. As we have seen in preceding chapters, there are several different kinds of morphological information, whose integration into the grammatical systems of natural languages may be quite different. These include (at least) the sorts of material in (12).

(12) a. Derivational material, which represents the relation of one lexical item to another.
    b. Compounding, which is a special case of the creation of new words through a more 'syntactic' combination of pre-existing (full) words.
    c. Inflectional material, which reflects the way in which a surface word form is the overt interpretation of a lexical item in a specific syntactic position. Inflectional morphology is what is relevant to (and determined by) the syntax, when these notions are properly explicated.
    d. Clitics, which are phonologically part of a single word with their 'host,' but which do not specify properties of that word. They come in two flavors:
       (i) simple clitics are just phonologically deficient elements which, while leading a full life syntactically, have to lean on another word to get pronounced; while
(ii) special clitics represent properties of syntactic phrases (cf. the king of England's crown), and in fact are arguably the phrase-level analogs of word-level morphology.

There is no particular reason to expect all of these sorts of information to be processed in the same way, and in fact there is some reason to expect a variety of devices to be involved. The account we have offered in the preceding section is potentially most relevant to the analysis of inflectional material, though its extension to (at least some) cliticization phenomena seems straightforward. Different approaches seem indicated for other sorts of morphology, but it is necessary to start somewhere.

The most important difficulty posed by the deficiencies of existing systems is not merely the computational one of efficiently recovering morphologically encoded information for practical purposes; rather it is the apparent conclusion that for reasons of principle, an efficient parser could not incorporate in any direct way knowledge about linguistic structure with the form usually ascribed to that knowledge by theoretical linguists. If this is indeed true, it would indicate that linguistic theories might well be systematically misguided in fundamental ways.

By presenting an alternative approach to the parsing problem which shows promise of resolving this apparent contradiction between the nature of competence and strategies of performance, we thus potentially validate the significance of the class of linguistic descriptions entertained by most theoreticians of language. In terms of such a model, the details both of the theoretical description and of observed human processing behavior are directly relevant: the former because they determine the actual set of rules that the model makes use of in constructing and testing hypotheses; and the latter, because the behavior of the system can be compared in rather fine detail with that of human subjects. The extent to which such a procedure is potentially a genuine and principled model of linguistic performance is therefore quite striking.

The essence of this model is of course its reliance on parallel processing to avoid the problem of backtracking. Here we are surely on fairly certain ground. Little of significance is known about the properties of the actual neural 'hardware' with which human speakers process language, or at least little that would enable us to constrain the class of procedures that might be applied to this task. One thing that is known, however, is that human cognitive processing is unlikely to make use of long and complicated procedures applied very quickly one step at a time (comparable to the operation of standard serial computations). Rather, human neural computation is apparently quite slow (at least in comparison with the behavior that can be extracted from
silicon), but involves massive parallelism, with lots of things going on at the same time. In replacing a serial computation with a massively parallel one, the parsing strategy outlined above is presumably moving at least grossly in the direction of greater conformity with the sorts of processing that might be going on in the nervous system.

This observation, in turn, suggests another reason for pursuing such an analysis. Linguistics is by now a highly formal field, with rather explicit computations corresponding to most of its basic constructs. Central areas of the field, such as formal language theory, the notion of derivations relating underlying to surface form, etc., are routinely presented in the form of explicit algorithms when they are to be made precise. Our very concept of what constitutes a possible (or a plausible) rule, grammar, constraint, etc., is usually formed on the basis of its translation into some explicit procedure for effectively computing the nature of some class of linguistic objects. Now in fact the computations which are usually envisioned are exclusively serial ones: they proceed one step at a time, and it is the specification of the nature of these steps and their inter-relations that constitutes much of linguistic theory.

Suppose, however, that the processes underlying human linguistic performance are actually massively parallel, relatively slow, and locally rather simple, rather than serial and made up of an intricate sequence of many steps executed relatively quickly. In that case, our underlying sequential metaphors might be radically unsuited to the capturing of linguistic reality; and we would be well advised to seek a way of recasting the foundations of the field in terms of a more appropriate set of computations. In the present instance, the result may well be a validation, rather than a radical revision of accepted results. Once the kind of knowledge phonologists and morphologists attribute to speakers is interpreted in terms of parallel rather than sequential processing, it may be that this is not as remotely related to linguistic performance as is sometimes thought. Nonetheless, it may well be that there are important novelties and surprises in store for us when we attempt to take seriously the notion of parallel processing. It is most likely to be through computational-linguistic research that our horizons stand to be expanded in this potentially fundamental way.
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