Ann. Rev. Anthropol. 1983. 12:355–75

A DECADE OF MORPHOLOGY AND WORD FORMATION

Mark Aronoff

Program in Linguistics, State University of New York, Stony Brook, New York 11794

INTRODUCTION

In the last decade there has been a great resurgence of work in morphology, that part of linguistic theory devoted to the internal structure of words. This article will comprise a review of that work. My review pretends neither to completeness nor to impartiality. I have tried instead to take what seem to me to be the important developments and form them into a reasonably coherent picture of the field as it stands. Those I have omitted may enjoy the revenge of history.

Morphology is one of the oldest concerns of linguistics. The term *morphology* was coined in the early nineteenth century to refer generally to any science whose main object is form; the first specifically linguistic use dates from this early period and unlike many other terms its meaning has not changed significantly in the interval since.

Morphology was central to nineteenth century linguistics for two reasons. First, traditional grammar, out of which modern linguistics grew, had been morphologically based, as all of us know too well who have learned their Latin declensions and conjugations. Second, the comparative method of historical linguistics, which provided the most spectacular successes of nineteenth century linguistics, which indeed made linguistics into a respectable modern academic discipline, depends to a great extent on morphology. Morphological investigation therefore flourished along with historical linguistics. The beginning of the twentieth century, however, saw two major changes in the focus of the field, neither one of which was of great benefit to morphology: historical linguistics was supplanted by structural (synchronic) linguistics, and the discovery of the phonemic principle permitted the study of sound systems without reference to other formal aspects of language. Nonetheless, morphology continued to enjoy a respectable though diminished role in structuralist theory-

0066–4294/83/1015–0355$02.00

making, both in North America and in Europe, until the advent of *transformational generative grammar*. Excellent samplers of structuralist theory can be found in (45) and (39), which contain a fair number of articles on morphology.

Early generative grammar (24, 38) presented a comprehensive theory of grammar with only two main components, syntax and phonology. Semantics was set aside as being too difficult at that stage of the game, and morphology was partitioned between syntax and phonology. Though there was some protest at this partitioning (e.g. 75), and though there were isolated examples of excellent work on morphology during this period (e.g. 93), the 1960s, when linguistics flowered, were dark days for morphology.

The classic period of generative grammar ends with two great works, Chomsky's *Aspects of the Theory of Syntax* (25) and Chomsky & Halle's *The Sound Pattern of English* (27), known colloquially as *Aspects* and *SPE*. These works represent what is often called the *standard theory, Aspects* for syntax and *SPE* for phonology. On actual inspection, though, neither one of these books is as definitive as one might expect standard works to be. The prefaces to both emphasize that they represent work in progress, and if both books are truly classics, it is because they do not present the standard theory as a static framework, but rather show the framework pushed to its limits. It is therefore to these works that we should turn if we are to see why it became necessary to reintroduce a specifically morphological component into linguistic theory.

It is in *Aspects* that questions of morphology are first discussed directly by a generative theoretician. Prior to *Aspects,* the *lexicon* was viewed as nothing but an unstructured list of *formatives,* each consisting of a meaning and a form paired in the manner of the Saussurean sign. In *Aspects,* however, Chomsky proposed that those formatives which are *members of major lexical categories* (i.e. nouns, verbs, adjectives, and adverbs) should be regarded as *complex symbols* made up of various types of *features*. A large portion of the book is devoted to a discussion of types of syntactic features. However, the last section, some 30 pages long, entitled "The Structure of the Lexicon," is concerned specifically with how complex symbols might be used in the analysis of specifically morphological phenomena. This section is admittedly sketchy, but several years later Chomsky published a paper which elaborated on some of his earlier proposals. This paper (26) marks the beginning of serious work on morphological phenomena in generative grammar, for in it Chomsky explicitly claims that the derivation of certain types of morphologically derived complex words must be treated outside the syntax in an expanded lexicon of a type made possible by the complex symbols introduced in *Aspects*. This claim, though couched in modern formal terms, is in effect a return to the traditional view, which separates derivational morphology (or word formation) from syntax.

This separation also permitted a major revision in syntactic theory, for it reduced rather severely the types of phenomena which are covered by trans-

formations to the point where fairly rigid constraints on transformations might be proposed. Most of the phenomena which were removed from the new syntax were, not coincidentally, just those which most occupied the school of *generative semantics,* Chomsky's main theoretical rival at the time. Newmeyer (70) presents an interesting historical account of this rivalry. It is the latter area of constraints that has most occupied Chomsky's attention in the years since, and one might say that his interest in word formation was largely negative. Nonetheless, the field would not have flourished nearly as well without his initial impetus.

The change in syntactic theory had repercussions for phonology. In the standard theory of *SPE*, the syntax provides the input to the phonology. However, many of the phonological phenomena that *generative phonology* is concerned with arise only in morphologically complex words. For example, in English, changes in stress and vowel quality are almost completely confined to derivationally related sets, as the following examples illustrate: *telegraph, telegraphy, telegraphic; sane, sanity; degrade, degradation; combine* (verb), *combine* (noun). In *SPE,* the morphological structures were provided by the syntax. Chomsky's proposal that morphologically complex words be removed from the syntax therefore set phonology adrift. The syntactician might happily abandon his concern with word derivation and suffer no ill consequences. The phonologist could not, however, rest easy in such a state of benign neglect. Their phonology must rest on some structural base.

Once phonologists realized that the theoretical rug had been pulled out from under them, they sought vigorously for new firm footing. The need to rebuild their morphological foundation also provided phonologists with an opportunity: they could develop a morphological theory more responsive to their own demands than the previous purely syntactic one.

Thus the stage was set for the development of a morphological theory which could be integrated with the rest of the generative enterprise, and though no one can yet claim to have found a definitive theory of morphology, the last decade has seen a good deal of activity and even some progress toward this goal.

Morphology is conventionally divided into two parts. *Inflection* covers those word-internal phenomena which vary with the syntactic role of a given word (e.g. case, agreement, inflection); *word formation* deals with the creation of new nouns, verbs, and adjectives. Word formation itself is usually divided into *derivation* and *compounding*; compounding is restricted to cases where two or more words are joined to form one (e.g. *elevator operator*), while derivation covers those cases where only one word is involved (e.g. *elevation*). The borders of these areas are not entirely clear-cut. For example, it is not clear whether the formation of plurals in nouns is a matter of inflection or derivation. Nonetheless, the division is convenient enough so that little reason has been found to discard it. I will therefore adopt it without necessarily claiming any theoretical significance for it.

Crosscutting this division is the more pervasive one of syntax, semantics, phonology, and the lexicon. The product of these should give us eight distinct subareas. In fact, there are fewer. For example, the phonology of inflection and derivation forms a unit; nor has each remaining subarea received equal attention. I will therefore confine my discussion to the following: 1. the lexicon and word formation; 2. phonology and morphology; 3. the syntax of word formation; 4. the semantics of word formation. I will not discuss inflection separately because that area has received comparatively little attention until very recently (but see 4, 5, 21, 22, 86).

Historically, morphology was the last of the four traditionally recognized subparts of grammar to be granted independent status by generative linguistics. The reason for this tardiness is the difficulty in separating morphology out from the other three—syntax, semantics, and phonology. In fact, as some Europeans have emphasized (33, 46), morphology consists in large part of the interaction of the other three systems where they intersect—at the level of the word. Once this interaction is acknowledged, however, it may be exploited, for it allows one to proceed by triangulation. Every move that is made in one dimension will have consequences for the others. Interaction is accompanied by modularity: each system is independent in theory, but no analysis which treats one in ignorance of the others can ever achieve explanatory adequacy. The best work in morphology recognizes these twin assumptions of modularity and interaction, and it is on work of this sort that I will concentrate my efforts.

THE LEXICON AND WORD FORMATION

Morphology is responsible for describing the internal structure of complex words. Since the lexicon of a language is by and large comprised of such words, morphology is generally assumed to be restricted to a description of the lexicon. In fact, however, this assumption leads inevitably to severe problems, and little progress can be made until it is modified. The problems and their solution are as follows. First, the sole generally recognized criterion for any item being listed in the lexicon of a language is its arbitrariness or irregularity. This criterion was first made explicit by Bloomfield (14), though Saussure had already recognized that even partially motivated complex signs must be listed. All and only those items which are irregular in some way are to be listed in the lexicon. As it happens, and for reasons which are still unknown, the majority of the items found in any lexicon, including traditional dictionaries, are nouns, verbs, and adjectives. These same categories also comprise the domain of morphology, so that it is easy to see why the lexicon was regarded as equal to the domain of morphology. But the lexicon is inherently irregular, and as long as morphology was held responsible for *all* the properties of *all* the members of the major lexical categories, it was doomed to the task of accounting for a

highly irregular set of data. The solution to this basic difficulty is to free the morphology from its obligation to handle lexical irregularities directly. Instead the task of morphology should be restricted to describing directly only the possible but nonoccurring words of language, a set which is presumably regular, so that then the regular properties of the actual words in the languge (those which are listed in the lexicon) might be described derivatively. This general solution to the relationship between the lexicon and morphology, first made explicit in (7), has formed the basis of much work since. There are several ways of dealing with the derivative description; the most common is by means of redundancy rules (44), and various ways have been proposed to constrain these rules (78).

More recent work, however, has shown that even this indirect relation between morphology and the lexicon must be taken as fairly abstract. In early treatments, the word formation component was considered to be responsible for the addition of new words to the lexicon, which meant that the morphology had to account for all the properties of *new* words, though it was absolved of complete responsibility for old words. However, the actual use of a new word is conditioned by factors other than word formation rules, as Dressler (33, 34) has demonstrated; nor do all new words become part of a speaker's vocabulary (6). For such reasons, it is best to make a strong distinction between the rules by which words may be formed and the actual coining of words, only some of which may enter the lexicon. If such a distinction is made, then the rules must be viewed as abstract patterns to which potential words should conform to some degree rather than as rules which completely determine the form and meaning of all new words.

Word formation usually involves affixation, though there are cases of *zero derivation,* such as the derivation of English verbs such as *pilot* from the corresponding noun, discussed in (9). Because of this special relation between word formation and affixes and because of the fact that affixes may not stand alone, but always depend on a stem, it was proposed in (7) that all affixes be treated as parts of word formation rules (each affix being assigned to a particular word formation rule), rather than being given a separate lexical entry. That proposal has since been challenged on two fronts. On the one hand, affixes certainly are arbitrary signs, and on this ground alone should be given lexical entries. If so, then having each affix also be part of a rule means that affixes are listed twice, once on their own and once with the rule. The only possible reason for not providing affixes with entries is the desire to restrict all lexical entries to stem or words of the categories noun, verb, and adjective. But such a restriction, though appealing on an intuitive level, is impossible, since higher units, such as irregular inflected forms, phrasal idioms, and even sentential forms such as proverbs and syntactically anomalous fixed expressions must have lexical entries. The preponderance of nouns, verbs, and adjec-

tives is only a statistical fact. Affixes should therefore be listed in the lexicon. In addition, it has been argued by Slavists (12, 13, 65) that derivation and affixation are distinct phenomena. One type of derivation, say deriving an abstract noun from an adjective, may be represented by more than one affix (e.g. *passiveness, possibility, presence*), while one affix may represent more than one derivational type (e.g. *monetarism* vs *Reaganism*). Affixes, like other formatives, are not reliably unambiguous. It is therefore reasonable to conclude, as many have (56, 78), that affixes are not introduced by word formation rules in the manner described in (7) and that the theory of derivational types must be separated from the theory of affixation, even though the latter instantiates the former.

These theoretical changes, however, though seemingly drastic, have few practical consequences. Most analyses can be expressed either with or without word formation rules interchangeably. Kiparsky (48) has in fact proposed that all lexical entries be regarded as rules, suggesting that the two views are notational variants.

Thus, though there have been changes in the exact mechanisms proposed to account for word formation, the initial observation still remains valid, whether as a theoretical tenet or simply as a heuristic caveat: the study of word formation can be successful only if it is concentrated on potential rather than actual words. Indeed, not even all novel words fall under the domain of the morphology. Beard (13) has demonstrated that there are processes of what he calls "lexemic extension," including such things as *blending* (e.g. *chunnel* derived from *channel tunnel*) and acronyms, which fall outside the realm of morphology proper. The exact relation between word formation and the lexicon is therefore much less direct than one might think.

Word formation, since it interacts with the lexicon, may also tell us something about the structure of the lexicon, an issue which is of great interest to psychologists as well as to linguists. For example, the base (that element to which affixes attach) in almost all types of productive word formation is an uninflected form of a noun, verb, or adjective. Most often it is the bare stem of the word in question; sometimes a stem augment (such as a theme vowel) is present; there are also instances, most typically in Semitic, where a root may be extracted from the stem. Almost without exception, though, a given affix will not attach to more than one particular form of a given word. For the purpose of word formation, therefore, these related word forms can be treated as a single unit or *lexeme*. It is reasonable to conclude from this pervasive pattern that the lexicon is organized in much the same way as a traditional dictionary, with all inflected forms and augmented stems being grouped under the same entry as the bare stem (8, 60). Another example of the interaction of word formation with the lexicon is the well-known phenomenon of *blocking*, whereby a particular potential word which we might expect to occur on other grounds is not found

because there already exists another word in the same stem of the same derivational type and meaning. So we do not find *beautifulness* because we already have *beauty*, even though the first is a well-formed word (cf *bountifulness,* which is acceptable because *bounty* has a different meaning). In order for blocking to be as pervasive as it is, it must be that speakers, when they form a potential word, are able to scan very quickly all words in the same stem; they will not normally use the potential but nonoccurring word if a blocking word exists. We may therefore assume with some confidence that the lexicon is organized so as to facilitate scanning of just this sort (15). It has been noted (6, 10) that very productive word formation rules tend to be immune to blocking; words formed by productive processes are also the most ephemeral (18); speakers asked to judge novel words are also most likely to confuse actual words and potential words in case they are formed by productive processes. It therefore appears that the output of productive word formation rules is less likely to be even checked against the lexicon before use.

Hypotheses like these are just the sort that should be subject to psycholinguistic experimental verification. There has been some work along these lines (6, 15, 30), but most psycholinguistic studies of the lexicon and lexical access are done without the benefit of a knowledge of morphology. This should change as psycholinguists and morphologists begin to communicate more closely.

PHONOLOGY AND MORPHOLOGY

Morphology and phonology interact in very complex ways. Indeed, much of modern linguistics can be seen as an attempt to separate the two. Nonetheless, the following interdependencies are clear. Most obviously, the structure of phonological representations is determined in large part by morphology. Second, particular phonological processes may make reference to morphological factors. Third, morphemes have phonological forms. The first question is fundamental to phonology. As noted above, the abandonment of word-internal structure by syntacticians was one of the main impetuses for the renewal of interest in morphology. The most important theoretical foundation of phonology to be left unanchored was the *phonological cycle*. Within the theory of *SPE,* phonological rules operate cyclically, starting from the innermost morpheme and working outward, each cycle being triggered by the addition of additional morphophonological material, until the word is exhausted. The word *reorganization,* for example, would be treated as follows: first *organ* is dealt with, then *organize* (unless we treat *organize* as monomorphemic, in which case we skip the cycle on *organ*), then *reorganize,* then *reorganization*. The structure of the word must therefore be [[re[[organ]ize]ation], where each pair of left and right brackets indicates a successively larger domain. But what provides the

structure, and why this particular structure rather than another? Chomsky & Halle (27) assumed that the syntax provided the structure, though they never quite spelled out how. Morphological theory provides the answer very simply. The layering results from successive applications of word formation rules, each affix being added by a single rule (7). This observation also extends to other phenomena dealt with by Chomsky and Halle in detail, such as English compound nouns, whose stress pattern depends crucially on layered bracketing of the sort that follows naturally from a word formation rule of compounding which adds a single new word at a time (27, 55). Thus [[high school] principal] and [deputy [school administrator]] have different stress patterns because they have different morphological structures. The morphology automatically provides exactly the type of labeled bracketing which is necessary for the phonology to operate and may therefore be assigned the structure-building role previously assumed by the syntax.

The contribution of morphological theory to phonological structure is so simple and elegant that little has been said about it beyond the initial observation that it works. There is, however, one rather technical issue which has been so hotly debated that it should be discussed here, and that is the question of *levels* or *strata* of affixes. In *SPE* it was noted that there are two types of suffixes in English, those like *-ity* which interact phonologically with the word to which they are attached, and those like *-ness,* which are insulated. Contrast, for example, the pair *pompous/pomposity* with the pair *pompous/pompousness*. In the first pair, there are changes in stress and vowel quality when the affix is added, while in the second pair there is no change. Similarly for *photograph/photography/photographing* and numerous others. Most of the phonological differences between the two types of affixes, termed *neutral* and *nonneutral* in *SPE,* can be accounted for if, as in *SPE,* each type is attached with a different *boundary symbol,* nonneutral affixes with the *morpheme boundary* for which the symbol + is used, and neutral affixes with the *word boundary* for which the symbol # is used; since cyclic phonological rules do not operate across words, # affixes like *#ness* will be insulated in the desired fashion. On the other hand, + does not block any phonological rules, so that cyclic rules will operate on + affixes like *+ity*.

Within the literature on morphology, there have been a number of attempts to ground this analysis in theory. Siegel (80) first observed that neutral # affixes do not usually appear inside nonneutral + affixes, though the reverse order is common. She proposed that this ordering observation as well as the other peculiarities of the two types were the result of the interaction between the morphology and the phonology. According to Siegel, affixation may apply either before the rules of the phonology are given a chance to operate (as with + affixes) or after the cyclic phonology (as with # affixes). Since the attachment of the former precedes the latter, they will always fall inside, and since the latter

are attached after the cyclic phonology has operated, they will be immune to cyclic rules. Since then, various modifications to Siegel's theory have been made (1, 66, 78, 83–85), none of which has unequivocally won the field. In addition, skeptics deride the entire phenomenon, pointing out that Siegel's original observation about the order of types of affixes has many exceptions. It is contradicted in English by such cases as *developmental, vietnamization,* and *derivability*, in all of which a + affix is found outside a # affix, as well as in words like *ungrammaticality* and *reeducation* where a + suffix must be added after a # prefix if the morphological and semantic structures are to be isomorphic (91). Some also claim that the distinction between types is an artifact of the history of English, # affixes being by and large Germanic and traceable to Old English, while + affixes are mostly Latinate, and borrowed either through French or directly from Latin and Greek. Unfortunately, though the historical facts are true, the existence of the two types of affixes is not peculiar to English. The same two types of affixes with the same general phonological and even semantic properties have been found in a totally unrelated language, Kannada (11). The existence of the two classes, though it may be traced to the history of English in some sense, is still principled in another sense and must be explained, even though Siegel's theory and subsequent refinements of it must be false because of the ordering facts noted above. Recently, the two levels of affixes have been related to a fairly old distinction, that between *stem* and *word*. It appears [following (48, 78) with some modification] that the two levels of affixes can be accounted for if we assume that + boundary affixes treat their bases as cyclical stems, while # boundary affixes treat their bases as words. Cyclic rules will operate only within words containing stems, so that in a word like *development,* where *#ment* is a word forming affix, *develop* will be treated as a word, and *ment* will not be processed by any cyclic rules, since it is not a word containing a stem. In *developmental,* on the other hand, *+al* treats *#ment* as a stem, making *mental* eligible for rules of cyclic phonology, which explains why *developmental* has the stress pattern of a two-word compound noun, being constituted formally of two words, *develop* and *mental*. This proposal has two distinct advantages. First, it subsumes the boundary difference under the stem/word difference so that the boundaries may be eliminated (72, 77, 79). Second, it permits the occurrence of + boundary affixes outside # boundary affixes, a phenomenon found in Malayalam (66) as well as in English (91), without relaxing the requirement of strict compositionality (85).

The question of the relation between the rules which add morphemes and the rules of phonology brings us directly to another general topic, the importance of morphological factors in the statement of phonological rules (92). In structuralist theory, phonological phenomena were strictly divided into two types: *allophonic* and *morphophonemic*. Morphophonemic rules spelled out the variant forms of morphemes in terms of phonemes in specific environments.

Allophonic rules spelled out the variant realizations of phonemes in specific purely phonetic environments and were therefore by definition independent of all morphological influence. All morphophonemic rules preceded all allophonic rules. Some modern theorists (42) still subscribe to this clear-cut distinction. However, in one of the earliest and most controversial demonstrations of generative phonology, Halle (38) showed that this division is incorrect and that morphophonemic rules and allophonic rules can be mixed. Nonetheless, the feeling has persisted that rules whose environment is more morphological should in general precede rules whose environment is more phonological.

Various claims have been made about this ordering. In *SPE,* for example, a distinction is drawn between *lexical representations* and *phonological representations*. The term *lexical* refers to the representation of formatives provided in the lexicon. When inserted in utterances, however, lexical formatives acquire syntactically determined features for such things as case and tense. Only after these abstract features are spelled out by a set of rules called *readjustment rules* do we have a phonological representation upon which phonological rules operate to provide a phonetic representation. Note that Chomsky and Halle did not claim that all morphologically sensitive rules precede the phonology, only those which actually spell out syntactic features.

Much energy has been devoted recently to attempting to collapse the two representations, lexical and phonological, of Chomsky and Halle. For the most part, this is done by placing the readjustment rules in the lexicon. A class of rules has been isolated which operates on specific morphemes in the environment of other specific morphemes. For example, in English the Latinate root *vert* appears as *vers* when followed by the suffixes *+ive, +ion,* and *+ory,* as in *inversion* or *subversive*. The alternation of *t* and *s* is restricted to this root, as we can see from words like *insertion,* and it does not take place before all + boundary suffixes (cf *convertible*). These rules, called *allomorphy rules,* or analogs to them with other names, are assumed to operate in the lexicon (7, 20, 57). Allomorphy rules also spell out in the lexicon irregular inflections such as *stand/stood, man/men.*

It has further been proposed by Lapointe (49, 50) and others that not only irregular inflection but all inflection be done in the lexicon rather than in the phonology. In a parallel fashion, advocates of this position claim that the interaction of inflection with the rules of the syntax is also highly restricted. However, both these claims have been questioned by Anderson (2, 4, 5), who presents several cases in which the spelling out of inflection seems to be intertwined with both low-level phonological rules and general syntactic rules.

A more radical proposal is that of Mohanan (66) and Kiparsky (48), according to which all phonological rules that operate within the domain of the word are considered to be lexical, largely because they may have exceptions.

Mohanan's lexical representation is in fact very close to certain structuralist phonemic representations, especially that of Sapir (64, 74). A similar position is that of "upside-down phonology" (52), in which cyclic phonological rules operate in a reverse direction from that normally assumed, unraveling the surface rather than constructing it.

As Mohanan points out (66), most of these proposals involve considerable enrichment of the lexicon. They are in fact incompatible with the traditional view of the lexicon as the repository of all and only exceptional items. There is nothing exceptional about most of the inflection that Lapointe regards as lexical, nor is there anything exceptional about an overwhelmingly large proportion of the compounds that Mohanan would assign to the lexicon. The same goes for many lexical rules of syntax. One might reply that by *lexical* we should read *lexicalizable,* but this would still beg many questions. What we need is a good term that refers to linguistic phenomena that have to do with words rather than phrases. In fact, most of these claims boil down to the assertion that morphology is distinct from syntax and phonology. Unfortunately, those who make the claims forget that morphology and the lexicon are two different things.

One consequence of the failure to distinguish lexical and morphological phenomena is that no account can be given of the correlation between semantic lexicalization of complex forms and the weakening of phonological boundaries along Stanley's strength hierarchy (82). It has often been observed that the stronger the phonological boundary between constituents, the less likely it is that the combination will be semantically arbitrary. For example, there are in English many pairs of words which differ phonologically only in that the first has a + boundary where the second has a # boundary. I have discussed these elsewhere (7). Sample pairs are *perceptible/perceivable, comparable/comparable, burnt/burned.* In all such cases, the + boundary word is idiosyncratic semantically, lexicalized. Chambers & Shaw (23) discuss a similar set of data in Dakota, consisting of minimal pairs of compounds. Again, the compound with the stronger boundary has the more predictable semantics. I also have published data from Kannada (11) which exhibits the same characteristics, and Mohanan (66) has a similar set of compounds in Malayalam. There is in fact every reason to suspect that the phenomenon is universal. No "lexical" theory that I know of, with the possible exception of (48), can handle it, simply because they all fail to distinguish between morphological and truly lexical matters. The same goes, by the way, for lexical theories of syntax, as Wasow (88) has pointed out.

I will now turn to recent work in what may be called the foundations of morphology—the question of the phonological form of morphemes. It has long been assumed that at some level of abstraction every morpheme has a single

phonological form tied to a single meaning. This assumption has its roots in the philosophical theory of signs, which dates from at least the sixteenth century (29). Much of modern linguistics can be viewed profitably as an attempt to find this level and to define its characteristics. Recent interest in this enterprise has focused on two areas. The first is the question of abstractness—how far can the basic representation of any morpheme differ from its surface manifestations? The second area is exotic morphemes—those morphemes which seem either to have no underlying form or at least peculiar form. The two areas are not really so separate, since a better understanding of unusual morphemes may help to narrow the problem of abstractness.

Abstractness is inevitable. Chomsky & Halle (27) point out that even the level called *phonetic* by earlier phonologists is abstract from a physical point of view. No two instances of any given sound are physically identical, and the goal of phonetics is therefore to isolate the physically abstract qualities which make them sound identical to the listener. Our problem is analogous to that of the phonetician. Most American speakers of English believe that the *t* sound in *write, writes,* and *writer* is the same. Yet we know that they are three different sounds and that their distribution is predictable. We therefore posit a single abstract phoneme *t* of which the three are contextual variants and assume that the speaker "hears" at the level of the phoneme (74). More abstractly, we know that the plural ending has three variants, *s, z,* and *ez,* as in *caps, cabs,* and *caches* respectively, and that the variation is predictable; we therefore assume that there is one underlying abstract representation *z* or which these three are manifestations, so that the plural morpheme is underlyingly phonologically unique, as the doctrine of signs predicts.

Inevitably, difficulties arise in the course of our reductionist enterprise. First, do we allow morphemes with no basic phonological representation? For example, many irregular English plurals contain none of the above variants, yet they are still legitimately plural. Should we then allow a purely semantic morpheme "plural," manifested by *i* in *alumni, im* in *cherubim, odes* in *octopodes,* and so on elsewhere, with the abstract *z* form underlying *s/z/ez* as the default case? Generative grammar says no. "Plural" is not a morpheme but a syntactic feature. It is spelled out differently in different cases, the default case being the *z* plural morpheme. But this means that we either allow many plural morphemes or we give up on the doctrine of the sign in some cases. Nor is this problem confined to grammatical morphemes. Are *sing, sang, sung* three separate morphemes?

A second problem is limiting the extent of our reductive enterprise. If, for example, we wish to handle such related pairs as *telephone/telephonic* or *permit/permissive,* then we must allow particular morphemes to condition phonological variation. But morphological conditioning is a Pandora's box so powerful that it permits us to relate words as far apart as *knee* and *gonad* (58),

unless we are able to impose on it conditions of a sort which have yet to be discovered.

Chomsky and Halle were fairly liberal in their treatment of abstractness. They placed few conditions on how far an underlying representation of a morpheme might differ from its surface manifestations or on how legitimate morphological relatedness was to be determined. There were a number of reactions to this attitude. One (42) was to abandon the doctrine of the sign with a vengeance by not attempting to provide single representations for morphemes unless the variation involved was phonetically transparent. This solution is probably too radical (40), but it has had a great influence in phonology. The second (47) was to place limits on the possible relation between surface and underlying forms. In any case, the doctrine of signs and consequent attempts to reduce every morpheme accordingly to a single underlying phonological form had been weakened to the point where it is no longer the central goal of most work in morphology. Within the lexical framework of Kiparksy (48), for example, the problem of abstractness is resolved by effectively making all of + boundary level morphology optional. In this framework, *telephone* and *telephonic* may be related if you are inclined to relate them, but there is nothing to compel you to do so.

Accompanying the movement away from abstraction has been a contradictory willingness to treat at least certain types of morphemes as having much more abstract representations than had previously been countenanced even by Chomsky and Halle. These morphemes are of two types, *base-dependent* and *autosegmental*. Both differ rather strikingly from the usual segmentally specified concatenating morphemes of European languages. The most common base-dependent morphemes are *reduplications* and *infixes*. In reduplication, a part of the base is repeated, while infixes are placed inside the base rather than in front or in back.

Tagalog is a well-studied language which is replete with both reduplication and infixation. My examples of each are drawn from (76). One form of reduplication copies the first consonant and vowel of a base. It appears in many derived word classes, usually preceded by an affix. Accompanied by the prefix *mag-* it produces a class of nouns meaning "vendor of the product designated by the base," as in the following pairs: *baboy* 'pig', *magbababoy* 'pig vendor'; *kandila* 'candle', *magkakandila* 'candle vendor'; *bulaklak* 'flower', *magbubulaklak* 'flower vendor'. This particular class is highly productive, and it is clear that no specific underlying representation can be given to the reduplicated affix. A common infix in Tagalog is *-um-*, which appears after the first consonant of its base, as in the following examples, where the infixed form has "actor focus": *kain* 'eat', *kumain*; *punta* 'go', *pumunta*; *dugo* 'bleed', *dumugo*. The problem with infixes is that they disrupt the integrity of other morphemes.

Both reduplication and infixation gained attention originally because of their importance for the question of the relative ordering of phonological rules and those rules which introduce morphemes (7, 20, 69, 89), though some attention was always paid to matters of form (62, 67, 68). Most recently, it has been suggested that these types of morphemes, which were earlier considered to have no basic phonological form at all, can be treated as regular affixes, albeit with a very abstract form, within a theory that is commonly called *autosegmental*.

This theory arose in connection with work on tone languages. It was discovered that many tonal phenomena could only be described adequately if the tones were treated as constituting a separate morphophonological tier (36, 51, 90). This autosegmental view has since been extended to other classes of phenomena. Most important for morphology, McCarthy (61) has shown how the Semitic verbal system can be analyzed within an autosegmental theory of morphology and has extended this theory to other nonconcatenative morphological phenomena. In Semitic, verb roots consisting exclusively of consonants are matched with tenses and aspects, each consisting of particular vowels in characteristic consonant vowel templates. In Modern Hebrew, the stem *ktv*, meaning 'write', can occur in the past tense as *katav*, in the present as *kotev*, in the future as *yixtov*, and in derived aspects such as causative *hixtiv*, intensive *kitev*, etc. Other verbs will have different consonants but the same vowel patterns. McCarthy shows how the consonantal roots, vocalic patterns, and templates can be matched by principles of autosegmental phonology, much in the same manner as tones are matched to segments in analyses of tone languages. As a consequence, though, he must admit morphemes with rather unorthodox forms. The lexical entries for verbs roots will be purely consonantal, those for different tenses and aspects will consist of particular vowels in templates with completely unspecified consonants. This same approach has also been used to analyze reduplication (59, 63), reduplicative morphemes being treated as segmentally unspecified or partly specified prefixes.

Analyses like these push abstraction to the edge. Not even Chomsky and Halle have morphemes whose underlying representation is so general as CV, as Tagalog reduplication would be in an autosegmental treatment. But it is important to note that with one exception (the Semitic roots, which may be susceptible to a less abstract treatment) all the morphemes for which these highly abstract representations are posited are *grammatical* operators. By limiting abstract representations to these and imposing more stringent conditions on members of major lexical categories (nouns, verbs, and adjectives), as has been suggested by a number of people (8, 25, 48), we may be able to deal with the problem of abstraction in a better fashion. Whether we can impose such limitations is an empirical problem.

SYNTAX AND WORD FORMATION

Two major issues are grouped under this heading. The first concerns the proper division of labor between the syntactic component of a grammar and the word formation component. The question was first raised by Chomsky (26), who pointed out that certain phenomena, hitherto regarded as syntactic, should best be treated in a separate word formation component. Though Chomsky himself has subsequently done little work in this area, his original article spawned an entire enterprise, which generally goes under the name *lexical grammar* and which has several schools, the most prominent being the *lexical functional grammar* school of Bresnan. A representative sample of work within lexical grammar, along with a fine introduction, can be found in (41); (16) and (17) are also recommended. Most of this work deals with phenomena whose status is controversial. For example, a good deal of energy has been expended on discussions of passive constructions, with some arguing that passives are syntactic in origin, while at least one author (87) has claimed that some passives are lexical and some syntactic. Nor will the argument really be settled until there is a better understanding of the distinction.

In view of this uncertainty, I will concentrate my substantive remarks on the second question: the extent to which descriptions of phenomena which lie unquestionably within the domain of word formation must make reference to syntactic notions. The traditional position on this is that word formation rules may make reference only to syntactic categories and not to syntactic operations. Furthermore, only a limited type of syntactic category may be referred to; in particular, not phrasal categories. The first assumption has been questioned by analysts of Eskimo languages (73, 81), which are highly polysynthetic, having entire complex sentences expressed in one word. The jury is still out on this, since the languages are so unusual that it is difficult to agree even on individual analyses. The second assumption, however, has met with more difficulty. Even in such unexotic languages as German, the incorporation of phrases into words is common. Object-incorporating languages such as Mohawk reinforce the conclusion that phrasal categories must be referred to. However, within an *Aspects* theory of major lexical categories, the theoretical boundary between word and phrase is not all that clear-cut. In this theory, each noun, verb, and adjective has specified in its lexical entry a *strict subcategorization frame,* which determines the specific syntactic context within which the item may occur. For example, the frame for a transitive verb is [__NP], meaning that the verb must be followed by a *noun phrase* object, while that for an intransitive verb is [__], meaning that it may not have an object. According to *Aspects,* the subcategorization frame for any major lexical category consists of the phrasal category that immediately contains it. The frame for verbs is therefore *verb phrase,* for nouns *noun phrase,* and for adjectives *adjective*

phrase. The frame may contain no information below or above the level of that dominating phrase (see 25, pp. 95–100 for further details). Thus, the lexical entry for any given noun, verb, or adjective already contains phrasal information, though of a restricted kind. It is, incidentally, precisely this property of lexical categories that proponents of lexical grammar take advantage of in their reformulations of syntactic rules as lexical rules. If, therefore, we accept the necessity of subcategorization frames in lexical entries, with their limited reference to phrasal categories, we must also expect word formation rules, even if they make no reference to other syntactic notions, to permit mention of this same limited type of phrasal categories. Word formation rules involving verbs, for example, might refer to direct objects, indirect objects, or manner adverbs, because these are part of the verb phrase, but not to time adverbs or subjects, because they are outside the verb phrase. This prediction is borne out by such phenomena as the above-mentioned object incorporation in Mohawk (note the absence of subject incorporation) and English verbal compounds such as *baby sitter* and *well made* (71). Thus, the restriction against including phrasal material in words must be interpreted so as to exclude only material outside the subcategorization frame of a given word. Further work on Eskimo will tell us whether this must be relaxed further and under what conditions.

In addition to subcategorization, it has been suggested (3) that word formation makes use of thematic relations such as *agent, instrument,* and *patient* (35, 37, 43), rather than or as well as purely syntactic relations such as *subject* and *object*. For example, words containing the suffix *-ee* in English denote the patient of an action, which may be either the syntactic object or indirect object or subject of the base verb: *payee* (indirect object, cf pay the money to the woman), *nominee* (direct object, cf nominate the woman), *standee* (subject). Similarly, the suffix *-er* denotes either the agent or instrument of an action; if a verb has a nonagentive subject, then there is no corresponding noun in *-er*: depress/*depresser (He depresses me/*He is a depresser), but *tongue depressor* is fine, since it is an instrument. Such a finding is not unexpected, if the lexical entry for a verb contains a thematic representation in addition to more strictly syntactic information (17).

A related question is that of the syntactic classes of words to which word formation refers. It is fairly clear that more specific categories than the basic noun, verb, and adjective are involved, as many of the examples already given indicate. Nonetheless, the range of categories to which reference must be made is not known. Furthermore, no present theory of grammar has been able to give a good definition of even the basic categories, and some explicitly reject them, while most treat the basic categories as primitives. There has been almost no good work recently on the problem of dealing with these categories.

It is quite clear on inspection that the range of classes specified by rules of word formation is fairly great. Some rules form wide classes. For example, the

rule which forms verbs from nouns in English by zero-derivation (9) forms verbs of all sorts, transitive, intransitive, etc: *blanket, winter, piece together, tee off, feast on,* etc. The rule itself most likely specifies only that the output be a verb. The particular type of verb derived in individual cases is determined by other factors (28). But other rules produce specific subcategories of verbs. Most productive prefixes in English form only transitives: *think/rethink, talk/outtalk, walk/outwalk.* In these cases, though the base verb is intransitive, the derived verb must be transitive (19). It is therefore reasonable to restrict the rule so that it forms only transitive verbs, regardless of the category of the input. With nouns, there is fairly great variety in English. I know of no rule which simply forms nouns in the way that the zero verb rule forms verbs. In fact, the rule that forms nouns from verbs by zero-derivation forms nouns of a very specific type. Each such noun denotes an instance of the action of the verb: *punch*$_n$, *try*$_n$, *glance*$_n$, *assault*$_n$, *rebound*$_n$. Another quite productive rule which similarly forms a very specific class of nouns is the attachment of the suffix *-ism* usually to (proper) nouns, to form new nouns denoting a system of beliefs: *Platonism, Calvinism, vegetarianism, socialism.* The same suffix can also form nouns denoting a characteristic type of linguistic behavior: *malapropism, Churchillism, Micawberism.* Whether the two uses are related is not clear, but in any case they represent rather narrow classes of nouns. A similar range of cases can be found with adjective suffixes in English. Thus, *-ic(al)* and *-al* simply form adjectives related to the base noun: *philosophical, theological, remedial, exceptional.* However, *-able* is more specific. The derived adjective is passive and potential: something is *readable* if it can be read; it is *repeatable* if it can be repeated, etc.

Nor is English an isolated case. In most languages, we find rules that form very general classes of words and rules that are much more specific. The more general classes recur again and again cross-linguistically, but some of the more specific classes are highly individual. In Kannada, for example, there is a suffix which parallels English suffixes like *-ness* in forming abstract nouns denoting a quality or state. So, /doḍḍa/'big' and /doḍḍatana/'size'; /baḍa/'poor' and /baḍatana/'poverty'; /kaḷḷa/'thief' and /kaḷḷatana/'thievery'. On the other hand, the noun suffix -āṭa has no exact equivalent in any other language I know. Its meaning is demonstrated by the following pairs: /cellu/'to spill' and /cellāṭa/'spilling around'; /huḍuku/'search' and /huḍukāṭa/'searching all over'; /tikku/'rub' and /tikkāṭa/'skirmish'.

In many of these examples we seem to verge on semantics. These categories are surely not all syntactic in any common sense of the term. The examples therefore show that the categories which word formation deals with must go beyond the strictly syntactic. Whether there is a continuum between such clearly syntactic categories as transitive verbs and the more specific cases discussed above, or whether there is a sharp break at some point is not entirely

clear, though it is difficult to find any clean dividing line. Nor can we even say, for some of these cases, whether the categories are semantic rather than pragmatic (cf *-ism*). Having come this far, though, I will turn to semantics.

SEMANTICS AND WORD FORMATION

Modern linguistic semantics has two main branches, *formal semantics* and *descriptive semantics*. Formal semantics has its roots in philosophical logic and is still closely tied to philosophy. There has been a great deal of activity in this area in recent years, especially in the adaptation of notions of formal semantics to the analysis of natural languages. However, most of this activity has been directed at syntax, nor morphology. The most notable exception is Dowty's work on Montague semantics and word formation (32). Descriptive semantics, also known as *lexical semantics,* is a more purely linguistic enterprise, with roots in the nineteenth century. Almost all practitioners of descriptive semantics hold to some version of the thesis of *lexical decomposition,* according to which the meaning of a word can be broken down into component parts, though the exact nature of these components and their relation to one another remains the subject of sometimes heated debate. A related thesis, that of *semantic compositionality,* states that the meaning of any complex form is a function of the meaning of its parts. Within the last decade, there has emerged a fairly coherent view of the descriptive semantics of word formation which, while accepting both these theses, has incorporated them more indirectly than in the past. Though there has been no explicit recognition of any agreement on this point, it seems that most recent work on the semantics of word formation shares the following assumptions: description should be concentrated on potential rather than on lexicalized words, with little attention paid to unproductive patterns; most potential words have a range of meanings rather than a single meaning, and the task of word formation semantics is to delimit this range rather than to predict exact meanings; the choice of a single meaning is determined by linguistic and nonlinguistic context; pragmatics plays a great role in the determination of word meanings, and we must recognize the interaction of pragmatics and semantics in the case of both potential and actual words; the semantics of complex words is compositional, but only once we abstract away from pragmatic and contextual factors. This view is much less ambitious than those of Lees (53) or the generative semanticists (54), who try to derive much more explicitly the meanings of individual words.

One of the earliest and probably still the best example of work along these lines is Downing's (31) analysis of English compounds, which replaces the diverse semantic types into which previous investigators had categorized compounds with the single relation "N_1 is related to N_2" accompanied by independent pragmatic and cognitive conditions and the recognition that words must

name (at least momentarily) significant things. Other work has followed this lead in proposing very sparse semantic characterizations for rather complex sets of data (9, 28), and there is always a temptation to reduce as far as possible in semantics, so that one might try to describe all word formation semantics in terms of the interaction of pragmatic factors with very simple semantic rules, as suggested in (9). Unfortunately, it is fairly clear that we need more than this. I have already noted a number of cases where the semantics of a particular class of derived words is fairly specific and not relatable to either syntactic or semantic factors (see the discussion of English *-ee, -er,* and zero-derived nouns, and Kannada -āṭa), so that we must assume a more complex semantic representation for the affix involved. Much work quite clearly remains to be done in the area of semantics and word formation, but the questions that must be asked are fairly clear. This alone signals progress.

CONCLUSION

Morphology was once viewed as the key to understanding language. The last decade has seen a renewed interest in this neglected area of investigation, an interest which appears still to be growing. We are not so naive anymore as to believe that one single approach will solve all the mysteries of language, but I hope to have shown that if morphology is indeed a better key, it is precisely because when morphology is done well questions are raised and perhaps even a few answers given which shed light on a variety of aspects of that most complex of human activities.

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