

The Phonological Component as a Parsing Device

William R. Leben

1. THE APPROACH

This paper will deal mainly with the problem of accounting for idiosyncratic morphophonological properties of words. Past approaches have ranged from ignoring these properties altogether to describing them as if they were on a par with the more productive alternations and phonetic processes of the language. I will argue that the phonological rules of a language apply in two blocks. One block, containing the productive phonological rules, converts underlying phonological representations into their phonetic realizations. The rules of this block will be termed phonetic rules. The other block, containing the phonetic rules plus rules of a more idiosyncratic type that are often termed morphophonological, performs a different function and operates in a different way. The rules of this block operate in reverse, taking the underlying phonological representations back to more remote representations for the purpose of satisfying the description of morphological rules. This procedure provides a way of capturing systematic morphological relationships among words by parsing morphologically complex words. The rules of this latter block will be termed parsing rules, and the model that captures the phonological and morphological relationships among words in the way to be described will be termed a parsing model, since it aims to model the ways in which speakers deal with parsing morphologically complex words that are systematically related to simpler words. I will argue, on the one hand, that this model makes for a more adequate treatment of morphophonemic alternations than the system of Chomsky and Halle (1968: SPE) and, on the other hand, that it provides an appropriate comple-

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ment to the treatment of phonetic rules in frameworks with relatively concrete phonological representations, such as natural phonology and natural generative phonology.

The approach to phonology proposed here mirrors to some extent the approach to morphology outlined in Aronoff (1976). Morphological rules apply in two blocks. Rules of word formation generate words that are not in the lexicon, and rules of word analysis parse existing words. The functions of word formation and word analysis are separate, even though the rules involved may be the same. The lexicon contains "all and only those words which are exceptional, i.e. arbitrary in at least one of their features" (Aronoff, p. 43). The claim I make for phonology parallels this, except for the fact that I will maintain that the phonological rules for word analysis contain as a proper subset the phonological rules that apply productively; in addition to these there is a set of rules with a purely morphophonological or interpretive function. In addition, whereas Aronoff provides for the morphological structuring of the lexicon by means of rules of word analysis, I will assume that the application of phonological rules in word analysis has no direct effect on the phonological structuring of the lexicon; e.g., if we undo a rule changing *k* to *s* in a given form, we do not change *s* back to *k* in the lexical entry. Instead, the undoing of phonological rules is simply part of the procedure for establishing the morphological relatedness of words.

A consequence of the proposal to exclude from the lexicon information about the purely morphophonological behavior of words is that special diacritic features, or suppletive representations of the type proposed by Hudson (1974), are superfluous. For instance, the fact that the final vowel of *cello* is truncated in *cellist* while the final vowel of *solo* remains in *soloist* is captured not by distinguishing the bases *cello* and *solo* in any way but rather by listing *cellist* and *soloist* directly in the lexicon. Similarly for the application vs. nonapplication of Trisyllabic Shortening in *profanity* vs. *obesity*. How the grammar deals with such differences is described and motivated in some detail below. But there is some initial plausibility to the idea that the locus of exceptionality of *obesity* is in the word *obesity* itself rather than in its base *obese*. Consider the word *highness*, which among its meanings has the idiosyncratic property of being a title of honor. It would be needlessly roundabout to capture this fact by marking the adjective *high* to undergo a special semantic rule when *-ness* is attached. I can see no objection to handling *highness* in the more direct way of listing it lexically with its special meaning.

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Furthermore, as Aronoff (1976: 18-19, 32-33, 38-39) points out, the word *transmission* can refer to a car's transmission in addition to referring to the act of transmitting, and the word *monstrosity*, unlike *porosity*, *curiosity*, etc., is difficult to interpret as referring to a quality. Such idiosyncrasies are captured by listing *transmission* and *monstrosity* in the lexicon with their meanings. As Aronoff proposes, the morphological rules for *-ion* and *-ity* specify a semantic function defining the meaning of the derived word in relation to the base word. By comparing the divergence between the actual meanings and predicted meanings, the grammar captures the extent to which the semantic correspondences are regular.

Such an approach provides the beginnings of a model of how we come to associate the meanings of a morphologically complex form with the meanings of its parts. For someone who considers *severance* to refer only to the compensation received when one is separated from one's job, there is still a relation to the verb *sever*, even though we cannot predict this meaning from *sever*. Similarly, the term *cubist* bears an obvious, though indirect, relation to *cube*. We do not redefine *sever* and *cube* on the basis of *severance* and *cubist*. Rather we analyze the meanings of the derived words in terms of the meanings of their parts. The approach to idiosyncratic morphophonological properties outlined in this paper is similar in that it does not seek to redefine the phonological and morphological features of *solo* and *cello* on the basis of their behavior before the ending *-ist*. Instead it takes the derived words as given and defines the rules that work to relate these derived words, despite their differences, to the appropriate bases.

2. A NOTE ON PHONOLOGICAL REPRESENTATIONS

In generative phonology, different sorts of considerations have led to conflicting positions on the degree to which underlying phonological representations may differ from surface forms. SPE avoids placing any generally specifiable restrictions on the correspondence between underlying phonemes and their systematic phonetic realizations, apart from the requirement that both be represented by distinctive features drawn from a fixed inventory and that the rules of correspondence satisfy certain formal requirements. Each specific phonemicization is decided on its own merits,

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as determined by a general evaluation measure. This constitutes an interesting way of abandoning the strictures of classical phonemic theory that, as Halle (1959) and Chomsky (1964) demonstrate, lead to lost generalizations and are difficult to define consistently—interesting in that it leaves phonology with a theory, yet one that differs markedly in some respects from its predecessors. Still, there are signs that the theory is wrong, judging from evidence, principally from linguistic change, suggesting that additional restrictions can and should be placed on the construction of underlying representations. The pioneering work of Kiparsky in this area has been pushed further by many other researchers, leading, among other things, to the formulation of competing theories, such as natural phonology (Stampe 1973b) and natural generative phonology (Vennemann 1971, Hooper 1976). Unfortunately, the frameworks that propose the strongest restrictions on phonological representations represent a weaker theoretical position, a paradox that has yet to be fully appreciated. Consider, for example, the position summarized by Hooper (1977): “The major claim of natural generative phonology is that speakers construct only generalizations that are surface-true and transparent.” This severely restricts underlying representations by limiting the types of rules that express their correspondence to phonetic manifestations. But the theory, in order to provide for phenomena that do not lend themselves to treatment by rules meeting the conditions just cited, contains an escape clause. There are “via rules,” unconstrained by the theory, to express lexical correspondences that cannot be captured by surface-true, transparent rules (Vennemann 1972a, Hooper 1976). Similarly, the approach to natural phonology outlined by Donegan and Stampe (1977a) makes no allowance for phonological relationships that fall outside the domain of natural processes:

The phonetically natural aspect of phonology (as in the [s] : [z] alternation of German *Haus* : *Häuser*) is distinct in its nature, evolution, psychological status, and causality from the phonetically conventional aspects, whether the latter have taken on morphological motivation (as in the *au* : *äu*, *a* : *ä*, *o* : *ö*, *u* : *ü* alternations of *Haus* : *Häuser*, *Rad* : *Räder*, *Loch* : *Löcher*, *Buch* : *Bücher*) or not (as in the *s* : *r* alternation of *gewesen* : *war*) . . . Natural phonology properly excludes the topic of unmotivated and morphologically motivated alternations. [Donegan and Stampe, p. 127]

Their examples point up the problem encountered if we seek to embed natural phonology in a theory capturing morphophonemic alternations as

well. Devoicing, a phonetically natural process, and umlaut, a conventional rule, both function morphophonemically in German. Thus, if we are to consider whether morphophonemic alternations figure in phonology, it is of little value to suggest that they do if natural phonology can handle them and that they do not if natural phonology cannot handle them. Below I show that though the two types of rule may be different, they are not totally different.

There is, in any event, a growing consensus that SPE's level of underlying representation is too abstract. Though there is hardly a consensus on the question of how abstract this level really is, or on what sorts of rules relate underlying to surface forms, how these rules are ordered, and so on, efforts at answering these questions have proceeded sufficiently far to warrant discussion of the subject to be treated in the present paper. Granting that underlying representations are closer to the surface than may have been thought in 1968, how does one now deal with the abstract phonological relationships captured in the SPE system? For example, granting that the vowel of *sane* is underlyingly distinct from the corresponding vowel of *sanity*, how can we capture the fact that knowledge of the language permits speakers to relate these two words without having to be explicitly taught that they are related?

Faced with a choice between the abstract underlying level of SPE and the more shallow representations of, say, Stampe (1973b), I think there is good reason to adopt the latter—but only if we can find an alternative way of securing the results that at first seemed to favor the more abstract level. The reason behind this choice is simply that the sorts of evidence (largely external) marshaled by Stampe (1973b) are more compelling than the sorts of evidence (largely internal) presented by SPE, especially when we can show that there are adequate ways of dealing with the internal evidence that depart from the assumptions of SPE. As argued by Stampe (1973b), as well as by Donegan and Stampe (1977a), if we hypothesize that words are encoded lexically in ways that abstract from redundancies resulting from phonetically natural processes, we can explain why these words undergo the changes they do in speech errors and in other novel situations. Whether or not one agrees with the particular characterizations of natural processes offered by Donegan and Stampe, this argument has some appeal, since it (i) provides a theoretically straightforward, nonarbitrary way of pinpointing the level of lexical representation and (ii) suggests a division between phonological rules that is hardly apparent from SPE: one block of rules is, in effect, ordered before the other. The first, containing the more idiosyncratic type of

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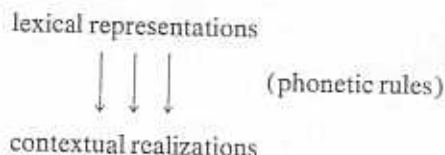
rule, functions (backward) only in the lexicon. The second block (which may also apply in the lexicon) contains only the rules that generate surface forms from lexical representations.

Since in this paper I am primarily concerned with the first type of rule, I will sidestep the open questions surrounding the second type by giving them the purely operational definition of being those whose effects show up in the tests devised by Stampe (1973b), involving transfer of rules to novel situations. I will assume that the level of phonological representation is the level that abstracts from the sorts of regularity that respond to these tests. This level, in order to avoid the famous problems for taxonomic phonemics discussed in Halle (1959) and Chomsky (1964), must not be so strongly restricted as to prevent Russian [dad,bi] or English [rajrər] from being interpreted phonemically as /dat,#bi/ and /rajd#ər/. That is, for reasons presented in Chomsky (1964), we may not impose the requirements of linearity, invariance, biuniqueness, and local determinacy on phonological descriptions. Yet suppose that, in accord with the operational definition of "phoneme" suggested above, we wish to bar the representation /rixt/ for English *right*, which SPE proposes in order to capture the behavior of the related form *righteous*. While it is conceivable that this might be done adequately by placing conditions on the actual rules that relate phonological to phonetic representations, an equally attractive possibility is to posit that any phoneme /P/, with the realizations [p₁, p₂, . . . , p_n], must be nondistinct from at least one of its realizations, in the sense of nondistinct as defined by Chomsky and Halle (1968: 336). Though the assignment of other phones to /P/ is not limited by this definition, we can eliminate many obviously incorrect correspondences, such as the assignment of [t^h] to /k/ in English, by the evaluation metric. Despite recent attacks on the evaluation procedure, I believe that it is an entirely suitable device for handling tasks of this sort.

The condition that a phoneme be nondistinct from at least one of its realizations, while permitting phonemicizations /dat,#bi/ and /rajd#ər/, suffices to rule out /rixt/ as a phonemicization of *right*, since English has no realization of putative /x/ that it is nondistinct from. Of course, there are numerous additional restrictions that one can imagine placing on underlying representations. But my purpose here is just to illustrate how a level intermediate between the systematic phonemic and systematic phonetic levels of SPE could be developed to accommodate the arguments that formed part of the foundation of early work in generative phonology.

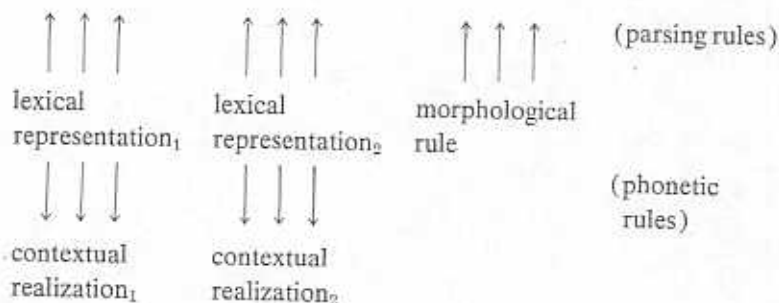
3. A PARSING APPROACH TO MORPHOPHONOLOGY

Suppose that we have a set of phonetic rules specifying the relationships between lexical representations of words and their phonetic realizations in context, pictured here:



Another set of rules, sometimes of a quite different sort, governs relations between lexical items. These rules frequently admit exceptions, are often less plausible phonetically, and are much less susceptible to transfer in novel situations. The distinction between the two types of rule is a fundamental one, and just as it is important not to confuse one with the other, it is important not to neglect one in pursuit of the other. Contrary to the unfounded assumption witnessed in some current work, the proper domain of phonology is the study of all types of regularities in language that make use of phonological terms. Below I discuss evidence for this assertion. Let me first illustrate how the more idiosyncratic morphophonological rules operate in the parsing model.

Briefly stated, the model takes arbitrary pairs of lexical representations, compares them with respect to a morphological rule, and attempts to make them satisfy the environment of the morphological rule by successively undoing layers of phonological changes. In derivations that are successful—where a match between a morphologically complex word and some other word is found—we say that the grammar has parsed the morphologically complex form. Now the picture given above can be completed:



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In this model only as many parsing rules are undone as is required to establish that a pair of lexical representations jointly satisfy the environment of an appropriate morphological rule. For example, as will be illustrated in greater detail below, *soloist* is identified as a derivative of *solo* and *obesity* is identified as the nominalization of *obese* directly at the lexical level, without undoing any morphophonemic rules. But to identify *cellist* as a derivative of *cello* and *profanity* as the nominalization of *profane*, certain phonological differences must be compensated for before they will fit the environment of the appropriate morphological rule.

This brings up one of the ways in which the present proposal differs from past approaches to morphophonemics, including the systematic phonetic representations of SPE. In the parsing model there is no morphophonemic level as such. Instead each parsing rule, or each permissible combination of parsing rules, defines a "level" of sorts, but such a level is reached only in case the morphology warrants it. As J. L. Malone (personal communication) has pointed out, this provides a nice way of dealing with the morphophonemic indeterminacy that has previously confounded researchers. For example, Malone (1970) notes that in Classical Mandaic a contrastively long consonant may have any of a number of morphophonemic interpretations. Three of these are /CC/, /?C/, and /C?/. But, Malone observes, for many nouns there is no principled way of determining what the morphophonemic source of their long consonant is, since in these nouns the long consonant does not alternate in ways that would reveal a morphophonemic source. Furthermore, Malone argues, Schane's (1968b) proposal that in such cases the ambiguity is resolved by choosing the least marked underlying representation would sometimes give the wrong results.

In the parsing model, this is not a problem. In fact, morphophonemic indeterminacy is a totally unsurprising phenomenon. Morphophonemes are not the source of anything. They are rather abstractions from phonemes and appear only when prompted by the morphology. Morphophonemic indeterminacy thus provides one sign that the phonological component is split up into two sections, whose rules have a quite different status.

For a simple example of a parse, consider the facts of (1), noted by Ross (1972) as puzzling cases.

- | | | |
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| (1) a. | violin | violinist |
| | b. solo | soloist |
| | oboe | oboist |

- c. cello cellist
piano pianist

Comparison of (1b) with (1c) shows that it is arbitrary whether a word loses its final vowel before *-ist*. We can encode this arbitrariness simply by listing *-ist* words in the lexicon. But the grammar must parse the morphologically complex forms, relating *soloist* to *solo* and *cellist* to *cello*. To do this, let us adopt the conventions in (2):¹

- (2) a. Rules that would apply in the order A, B, C in a conventional generative treatment are undone in the order C, B, A, except as provided by (2c).
b. A rule of the form $X \rightarrow [-F] / Y_Z$ is undone by replacing $[-F]$ with $[+F]$ on segment X in the environment Y_Z . Analogously, a rule of the form $X \rightarrow \emptyset / Y_Z$ is undone by replacing \emptyset with X in the context Y_Z .
c. A rule blocks if undoing it would not increase the compatibility of forms A and B with respect to morphological rule R.

The meaning of "compatibility" in (2c) will become clearer in the discussion of derivations (5) and (6) below. The rules needed to relate the pairs in (1) are expressed in (3) and (4).

(3) Word Formation Rule

$[X]_N \rightarrow [X-ist]_N$

(4) Truncation

$V \rightarrow \emptyset / _ - V$

Note that rule (4) is widespread, though not totally productive, in English. Along with applying in *cello/cellist*, *piano/pianist*, it applies in *Mexico/Mexican*, *orchestra/orchestral*, etc.

By the conventions in (2), representative pairs from (1) are related as in (5):

(5)	Word A	Word B	Morphology
a. LEXICAL FORMS:	/vājəlin/ _N	/vājəlinist/ _N	$[X]_N \rightarrow [X-ist]_N$
b. LEXICAL FORMS:	/sölō/ _N	/sölōist/ _N	$[X]_N \rightarrow [X-ist]_N$

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- i. Glide del
e.g. $j \rightarrow \emptyset$
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iii. $\bar{i} \rightarrow \emptyset / C$
iv. Vowel Sh
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FORMS:	/čelō/ _N	/čelist/ _N	[X] _N → [X-ist] _N
i. Rule(4)	—	čelVist _N	—

For cases (5a,b), no phonological rules need be undone in matching words A and B with the left and right member of the morphological rule; therefore, by condition (2c), no rules may be undone. In (5c), the lexical representations do not yield an immediate match: if /čelō/ is substituted for X in the left member of the morphological rule, X cannot be čel in the right member. Accordingly, we must undo the rule of truncation causing a vowel to be inserted before *ist* in /čelist/. By stipulating that X in the left member of a rule matches Y in the right member as long as X and Y are nondistinct, we guarantee that čelō and the derived representation čelV will qualify as matching each other in this rule.

The procedure just illustrated extends naturally to more complex cases, like *Christ/Christian*, using the SPE account of the alternations in this pair as a basis for constructing the derivation:

(6)	Word A	Word B	Morphology
LEXICAL			
FORMS:	/krājst/ _N	/krisčəŋ/ _A	[X] _N → [X-ijən] _A
i. Glide deletion e.g. j → Ø / č ___	—	krisčjən _A	—
ii. Palatalization e.g. t → č / ___ j	—	kristjən _A	—
iii. ī → Ø / C ___ j	—	kristijən _A	—
iv. Vowel Shift	krīst _N	—	—
v. Trisyllabic shortening	—	krīstijən _A	—

As one can judge from the phrasing of condition (2c), it is intended to apply purely locally. It is not permitted to look ahead in order to see whether a derivation will ultimately succeed or not. It does not presuppose a relationship between words A and B but rather is part of the procedure for determining whether the words can be related. Thus, for example, each step in derivation (6) satisfies (2c) without referring to future steps. Step (6.i) is well formed because insertion of *j* increases the compatibility of word B with the morphological rule. Step (6.ii) increases the resemblance between words A and B. Step (6.iii) completes the reconstruction of the suffix of word B, so that it matches the suffix in the

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[X]_N → [X-ist]_N

morphological rule. Step (6.iv) brings the stressed vowels of words A and B closer together, and step (6.v) makes the vowels identical.

The function of condition (2c), as it has been illustrated here, is to make derivations as brief as possible. In contrast to the approach taken in conventional generative phonology, in which derivations initiate with a systematic phonemic representation and terminate with a systematic phonetic one, derivations illustrated here often do not involve the reconstruction of a representation corresponding to the systematic phonemic level. Derivations are only as long as they need to be in order to make words A and B match the environment of a morphological rule, as is illustrated by (5) and (6). As a result, the present theory differs sharply in several respects from others that have been proposed. For one thing, as has been noted above, what was previously regarded as the systematic phonemic level is really not a level at all, since not all words receive an interpretation at this level, due to condition (2c). Therefore, one would expect that redundancies of the sort expressed by SPE in terms of systematic phonemes should be either devoid of psychological significance or expressible at some other level, using the terms appropriate to that level. The work of Greenberg and Jenkins (1964) and of Hooper (1975) gives some indication of how generalizations previously thought to belong in the domain of systematic phonemics can be expressed without presupposing the existence of this level.

In further contrast to SPE, condition (2c) provides a *principle* governing the length of derivations. To the extent that the complexity of derivations, as defined, say, by the number of steps in a parse, has a psychological correlate (for instance, in the time it takes a speaker to recover a morphological relationship or in the direction that a morphological class takes in changing), this model will make predictions, while the SPE model will make none. Below, in sections 6 and 7, I note some examples in which condition (2c) in fact plays a crucial role in explaining diachronic changes.

The procedure illustrated in (5) and (6) cannot, of course, be construed as guaranteeing that a genuine relationship exists wherever a derivation manages to make two words fit into the environment of a morphological rule. Indeed the process can run awry even in cases where no phonological rules are undone. We relate *cubic* to *cube* and *Chadic* to *Chad* but not *caustic* to *cost* or *comic* to *calm*. In view of this, we must stipulate that the parser specifies word relationships that are linguistically possible. It cannot certify that they are attested: this is the province of the lexicon. This is something that all theories of morphology have in

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common. In any theory, the phonological resemblance of *caustic* to *cost* is parallel to that of *cubic* to *cube*, and both pairs are, by virtue of their form, susceptible to being interpreted as related by the morphological rule forming adjectives from nouns by means of the suffix *-ic*. For the linguistic model to explain why some of these pairs are judged related by speakers while others are not, it will have to equip its morphological rules with semantic characterizations that must be satisfied by words related by such rules. In addition, the model must either abstract from speaker differences or attune its predictions to individual variations resulting from a complex of factors, including education, alertness, and pure chance. The parsing procedure, then, provides a necessary but not a sufficient condition for establishing morphological relationships.

4. ALTERNATIVE TREATMENTS OF EXCEPTIONS

The derivations in (5) illustrate how, equipped with condition (2c), the parser deals with the truncation of the final vowel of *cello* in *cellist* despite the retention of the corresponding vowel of *solo* in *soloist*, while expressing the obvious relationships. If we accept this account, there is no temptation to manufacture abstract ways of encoding the difference in the deletability of the final vowels of *cello* and *solo*. There would be no point, for example, in representing *solo* as $\overset{1}{s}\overset{3}{o}$ and *cello* as $\overset{1}{c}\overset{0}{e}$ and limiting truncation to deleting only unstressed vowels before *-ist*. Such a proposal would constitute what Kiparsky (1973b) has termed the diacritic use of a phonological feature and, for the reasons Kiparsky has given, deserves to be disallowed. Further, it suffers from a flaw shared by certain more direct attempts at capturing the difference in deletability. For example, one might mark the final vowel of *cello* but not the final vowel of *solo* with a special diacritic triggering a rule which truncates this vowel before *-ist*. Or, extending Hudson's (1974) and Hooper's (1976) proposal for inflectional morphology to derivational morphology, one might give *cello* the suppletive representation $cell \left\{ \begin{smallmatrix} \emptyset \\ o \end{smallmatrix} \right\}$, with a special rule selecting the first version, with \emptyset , before *-ist* and a general convention selecting the other version elsewhere.

Both alternatives resemble the approach I am advocating in that the difference between the two classes of words is captured, in effect, by a

list. If we choose the diacritic solution, the lexicon must say for each relevant entry whether or not it is marked with the diacritic. If we choose suppletive representations, the lexicon must say for each relevant entry whether or not it has this suppletive representation. Despite this similarity, however, the two alternatives just mentioned do differ empirically from the parsing approach, and I believe that the facts show that these alternatives are inferior. For one thing, the position that we capture the deletability of the vowel before *-ist* by a difference in the marking of the base forms *solo* and *cello* implies that if *cello* is marked to undergo deletion before a vowel-initial suffix, it should be realized as *cell-* not only before *-ist* but also before any vowel-initial suffix. By contrast, in the parsing model, any word not formed productively is listed in the lexicon, leaving open the possibility that even though *cell-* precedes *-ist*, the full form *cello* might precede some other vowel-initial suffix. I have found no crucial examples for words in *-ist*, but I suspect that, given that the relevant words could come into the language centuries apart, with no necessary regard for the morphology of words that have already come into the language, the disappearance of a vowel before one suffix need not have anything to do with what happens before another suffix. This suspicion is strengthened by pairs like *verb/verbal* vs. *adverb/adverbial*. Here, though we are not dealing with truncation of a vowel, the behavior of a morpheme in one word is quite independent of its behavior in another, assuming that the morpheme *verb* is common to both pairs.

Similarly, consider the morpheme *vert*, in *subvert*, *introvert*, *revert*, *divert*. This morpheme is discussed in Aronoff (1976: 105). Evidence that we are dealing with the same morpheme *vert* in all of these cases is that they share an idiosyncrasy in their nominalizations in *-ion*. Before *-ion* we get [ž]: *subver[ž]ion*, *introver[ž]ion*, *rever[ž]ion*, *diver[ž]ion*. Compare the regular reflex of *-t* in *assert/assertion*, *exert/exertion*, *contort/contortion*; here we always get [š], not [ž]. But now note that the morpheme *vert* does not always exhibit the same allomorphy. Before *-ive*, we get either *ver[s]-*, as in *subversive*, *introversive*, or *ver[t]-*, as in *revertive*, *divertive*. This sort of idiosyncrasy presents difficulties for a theory embracing diacritic features or suppletive representations. We cannot say that the morpheme *vert* contains a diacritic [+D] to trigger a rule converting *vert* to *vers* before *-ive*, because this would incorrectly yield **rever[s]ive*, **diver[s]ive*. On the other hand, we cannot say that *vert* has the feature [+D] in *subvert* and *introvert* but [-D] in *revert* and *divert*, since this would mean that the morphemes are not identical. Analogously, the words *subvert* and *introvert* cannot be given suppletive representa-

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tions *subvert* $\left\{ \begin{smallmatrix} s \\ t \end{smallmatrix} \right\}$ and *introvert* $\left\{ \begin{smallmatrix} s \\ t \end{smallmatrix} \right\}$, with a special rule selecting the variant in *-s* before *-ive*. Since this suppletive representation could not be posited for *revert* and *divert*, this would again obscure the fact that all of these words contain the same morpheme, *vert*.

In fact, the suppletive analysis encounters a more serious problem in these cases. The appearance of [s] before *-ive* is related to the appearance of [z̄] before *-ion*. The voicing difference is a result of the automatic devoicing of a consonant before *-ive*, as Aronoff (1976:106) notes. (See section 7 below for an account that differs somewhat from Aronoff's.) Thus a truly general suppletive account would represent the alternants as *subvert* $\left\{ \begin{smallmatrix} z \\ t \end{smallmatrix} \right\}$ and *introvert* $\left\{ \begin{smallmatrix} z \\ t \end{smallmatrix} \right\}$. [z] would then predictably be realized as [z̄] before *-ion* but as [s] before *-ive*. But in the light of *revert/revert*[z̄]ion, *divert/divert*[z̄]ion, the suppletive analysis would also posit *revert* $\left\{ \begin{smallmatrix} z \\ t \end{smallmatrix} \right\}$, *divert* $\left\{ \begin{smallmatrix} z \\ t \end{smallmatrix} \right\}$. Yet now we must somehow state that the first alternant, in *-[z]*, is selected before *-ive* for *subvert* and *introvert* but that the second alternant is selected before *-ive* for *revert* and *divert*. I see no way of doing this without sacrificing the claim that we are dealing with the same morpheme *vert* in all of these cases.

The point of this discussion has been to compare different ways of listing idiosyncratic features. What has been shown thus far is that diacritic features or suppletive representations do not adequately capture cases in which a given morpheme behaves differently for morphologically arbitrary reasons. The parsing model does not suffer from this defect. Because the words *subvert*, *subversive*, *subversion*, *divert*, *divertive*, *diversion*, etc., cannot be generated by productive rules, all are listed in the lexicon. The grammar captures the relationship of *subvert/subversive* and *divert/divertive* in the same way, by comparing these pairs in relation to a morphological rule of *-ive* suffixation and undoing phonological changes as required. By condition (2c), none are undone in *divert/divertive*; for the pair *subvert/subversive*, a rule changing *t* to *s* is undone. At the same time, the parsing of *subvert/subversion* is totally parallel to that of *divert/diversion*. Alternations before *-ive* and before *-ion* are discussed somewhat further in section 7, along with another argument showing that the parsing model distinguishes two types of exception, while the alternatives just considered do not.

A final position to consider is that the words *cello* and *cellist* are related by a "via" rule (Vennemann 1972a, Hooper 1976), which says that the vowel *ō* sometimes alternates with *Ø*. But this is not a real alternative,

since it says nothing. We have seen examples of possible via rules but never an example of an impossible one. Thus at present the claim that there are via rules is empty: nothing hinges on the existence of such rules. The via rule solution would be as consistent with the putative pair *cell/celloist* as with the real pair *cello/cellist*. Furthermore, the prospects for restricting these rules in a nonarbitrary way do not look very bright, if we continue to maintain that the function of via rules is merely to record that a speaker had an intuition of relatedness between two forms or between two sets of forms. The problem with this stems from the fact that our goal as theorists is, by definition, to find a way of predicting how languages will behave, and by extension how speakers will deal with a language they acquire. Our goal cannot simply be to find a way of recording an observed intuition. Via rules, as presently construed, satisfy the latter goal but not the former one.

There is a more positive way of stating this argument: the only type of via rule that it makes theoretical sense to posit is the parsing rule. If we find a use for a given rule in one reverse derivation, it will be available for use in others as well. Although there is no guarantee that a given rule will produce a successful match in all cases, we will see below, in the discussion of recoverability, that repeated failures will lead to change. This permits us to test the accuracy of a rule. If application of the rule to novel forms consistently predicts relationships where they are in fact impossible, then we know either that the rule is wrong or that it will soon be lost.

5. RULES THAT SERVE A DOUBLE FUNCTION

The distinction between phonetic processes and more idiosyncratic morphophonological operations is not always clear-cut, for phonetic processes can perform a parsing function as well. This is one reason for thinking that it is wrong—or at least hasty—to divorce phonetic influences from morphophonology, as advocated by Hooper (1977) and by Donegan and Stampe (1977a). An example is C Drop in Polish, formulated by Gussman (1976) as (7):²

(7) C Drop

$$[+ \text{cor}] \rightarrow \emptyset / \begin{bmatrix} + \text{cor} \\ + \text{ant} \end{bmatrix} \text{ — } \begin{bmatrix} + \text{cor} \\ + \text{nas} \end{bmatrix}$$

Among other things, this rule deletes *t* from between *s* and *n*, and *d* from between *z* and *n*. It is responsible for the forms on the right in (8), which

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are the ordinary unguarded discourse variants of the careful speech forms on the left. Examples are in Polish orthography except for the bracketed phonetic segments.

(8) <i>Careful speech</i>	<i>Ordinary speech</i>	
u[stn]y	u[sn]y	'oral'
po[stn]y	po[sn]y	'lenten'
zawi[stn]y	zawi[sn]y	'begrudging'
gwie[zdn]y	gwie[zn]y	'stellar'

(7) is in many respects a prototypical phonetic process. It applies generally in fast speech, does not admit lexical exceptions (though it need not apply), and involves a modification of the timing of articulatory gestures in that blockage of the air stream for *t* and *d* is delayed until the velum is lowered for the following segment, thereby obliterating the stop. In the last respect it resembles the sort of timing change described by Hooper (1976: 114–115). This is just the type of rule whose effects should not be reflected in lexical representations. The lexical forms are taken to contain the *t* and *d* of the deliberate speech variants in the left column of (8).

But in addition to being a fast speech process, (7) also performs a morphophonological function. To see this, consider first the morphological structure of the adjectives from (8). As expressed by (9), they are formed by adding an adjectival affix *-n* and an inflectional ending to a noun stem. Examples appear in (10).

(9) Word Formation Rule³
 [Stem – Ending]_N → [Stem – *n* – Ending]_A

(10) <i>Noun</i>		<i>Adjective</i>	
u[st]a	'mouth'	u[stn]y	'oral'
po[st]	'fast'	po[stn]y	'lenten'
zawi[ść]	'grudge'	zawi[stn]y	'begrudging'
gwie[zd]a	'star'	gwie[zdn]y	'stellar'

The noun stems for (10) are arrived at by omitting the final vowel, if there is one. The stem of a noun ending in a prepalatal segment or cluster is arrived at by ignoring its palatality; [ść], which corresponds to IPA [ç tç], is the prepalatal alternant of *st*.⁴ Thus the stem of zawi[ść] is *zawist-*.

Now, as Gussman notes, Polish has a fair number of adjectives similar to those in (8) in that they contain the sequences [sn] and [zn], but differ in that they lack a careful speech variant [stn] and [zdn]:

(11) <i>Noun</i>			<i>Adjective</i>	
	rado[śc]	'joy'	rado[sn]y	'joyful'
	nieszczę[śc]e	'woe'	nieszczę[sn]y	'woeful'
	bole[śc]	'pain'	bole[sn]y	'painful'

We can account for the lack of an adjectival careful speech variant in [stn] here by positing lexical /sn/, as opposed to the /stn/ posited for the adjectives in (8).⁵ But the fast speech rule (7) still serves a function in words like these: it fills in the missing *t* when we try to recover the adjective's correspondence to a related noun. For example, we employ this rule in parsing the form rado[sn]y, in derivation (12):

(12)	Word A	Word B	Morphology
LEXICAL FORMS:	rado/śc/ _N	rado/sn/-y _A	[Stem - Ending] _N → [Stem - n - Ending] _A
i. stī → śc (cf. fn.4)	rado/st-ī/ _N	—	—
ii. (7) C Drop	—	rado/stn/-y _A	—

Now the morphology can analyze rado[sn]-y as the stem *radost-* plus the adjectival affix *-n* plus its inflectional ending. This is a case in which a phonetic rule that any grammar posits also relates pairs of lexical representations.

Next consider the question, can the rules that parse lexical items be restricted to productive phonetic rules? Or, failing this, could we say that lexical structure not phonetically determined is purely haphazard? The facts at hand, I believe, show that either position would be arbitrary and incorrect.

For example, Isačenko (1972), cited in Aronoff (1976), shows that the Russian adjectival affix *-sk* (which appears in *leningradskij*, from *Leningrad*) occasions the deletion of preceding *sk* if this preceding *sk* is a morpheme. *Bask* 'Basque' does not lose its *sk* in *baskskij*, because this *sk* is not a separate morpheme. But *Tomsk* 'city of Tomsk' loses its *sk* in the corresponding environment, *tomskij*, because the base word is analyzed as /tom-sk/, derived from the name of the river Tom. The fact that the morphological structure of *Tomsk* continues to be perceived explains why the form **tomskskij* has never developed.

A good indication of the extent to which lexical structure need not be phonetically determined comes from considering the role of recoverability of lexical relationships, which is the subject of the next section.

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6. RECOVERABILITY AS A FACTOR IN LINGUISTIC CHANGE

A number of recent studies, including Kaye (1974, 1975), Eliasson (1975, 1977), and Gussman (1976), present evidence of a tendency in language to make phonological relationships recoverable. Although the relationship most often discussed in this context is between a given surface form and its underlying representation, we can restate the recoverability principle in light of the assumptions of the parsing model: morphologically complex words change to make their relationship to a base word more easily recoverable.

Increased recoverability provides the most direct explanation of the fact, discussed by Schuh (1972), that Hausa singular/plural pairs like *bawnaa/bakaanee* 'bush cow' and *buuzuu/bugaajee* 'Tuareg' are gradually losing their old plural in favor of a more transparently derived one, *bawnaayee* and *buuzaayee*. The rules for forming the plurals of this class, as described by Newman (1972), are these. Heavy roots add infix *-aa-* after the initial CVC, where V can be a long or short vowel or a diphthong. If we analyze the roots of the above forms as /*bakn-*/ and /*bugz-*/, this gives *bak-aa-n-* and *bug-aa-z-*. To this result, the ending *-ee* is affixed, giving *bak-aa-n-ee* and *bug-aa-z-ee*. The latter form becomes *bugaajee* by a general rule. The absence of *k* and *g* from the corresponding singulars *bawnaa* and *buuzuu* is a result of a historical process weakening syllable-final labials and velars to *w*, which gave **baknaa* > *bawnaa* and **bugzuu* > *buwzuu*. In the latter form *uw* is interpreted as *uu*, an exceptionless fact in Hausa. (The generality of Newman's account of plural formation is evidenced by singular/plural pairs *kaskoo/kasaakee* 'bowl' and *birnii/biraanee* 'city', which lack the morphophonemic alternations that complicate the first set of examples.) The innovative forms *bawnaayee* and *buuzaayee* follow the pattern of heavy roots containing a long vowel or diphthong, like *kiifi/kiifaayee* 'fish', *gawlaa/gawlaayee* 'idiot'. For the latter, the above rules first add *-aa-* after the root CVC, giving, for example, *gawl-aa*, and then they add *-ee*, giving *gawl-aa-ee*. (Note that the diphthong *aw* counts as V in CVC.) *y* is inserted between *aa* and *ee* by a general rule of epenthesis.

Schuh attributes the replacement of the older plural forms to the fact that the historical process weakening syllable-final labials and velars to *w* left Hausa with words in which *w* in the singular corresponded to a variety of consonants in the plural, including *f*, *b*, *β*, *m*, *k*, *ŋ*, and *g*. Rather than analyzing the *w* in the singular as underlying the appropriate labial or

velar consonant, Schuh proposes that their underlying forms are essentially the surface forms in these cases, that the singular is the base from which the plural is derived, and that accordingly each *w* in the singular is marked for one of a set of inverse rules selecting the appropriate consonant in the plural. (See Vennemann 1972a for a discussion of inverted rules. The rules in the case at hand are inverted in the sense that the historical rule changed consonants to *w* while Schuh's synchronic analysis contains a set of rules taking *w* back to its etymological sources.) Schuh comments that this situation is difficult for speakers to deal with and thereby explains why speakers have gradually been changing their plurals. They eliminate the special markings on *w* in the singulars, causing them to be realized as [w] in the plural as well.

But, as noted in Leben (1974), this analysis forces one to posit a stage in which a previous condition on plural formation was lost, followed by a stage in which the same condition mysteriously reappears. Prior to the alleged rule inversion, the underlying sequence CVwC is interpreted as C-diphthong-C, and so *-aa-* is placed to the right of CVwC in plurals. In the proposed stage of inversion, when etymological syllable-final labials and velars are rephonemicized as *w*, this interpretation must be relaxed, so that /bawn-/, for example, can become *baw-aa-n-ee*, which goes to *bakaanee* by an inverse rule. Finally, as the older plurals are lost, the earlier interpretation of CVwC re-emerges, so that /bawn-/ gives /bawn-aa-ee/ > *bawnaayee* in the plural. This is hardly a satisfying scenario.

With the parsing model, it is possible to capture Schuh's basic insight while avoiding the anomaly raised by the putative rule inversion. The morphologically complex forms are changing so as to increase the ease of recovering the relationship between singular and plural. In the light of the unpredictability of the plural from the singular, we list plurals in the lexicon along with singulars, and we measure the recoverability of the singular/plural relationship in terms of the number of rules that apply in a reverse derivation. For older singular/plural pairs, such as *bawnaa/bakaanee* and *buuzuu/bugaajee*, several rules must be undone before *-awn-* and *-uuz-* in the singular can be identified with the corresponding sequences *-ak . . . n-* and *-ug . . . j-* in the plural. For the innovative forms, no phonological rules need be undone at all: *bawnaa/bawnaayee* and *buuzuu/buuzaaayee* are transparently related, especially since, as shown in Leben (1977b), the parsing approach permits one to formulate the Hausa plural formation rule as attaching *-aayee* to a singular stem.

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There is another type of morphologically motivated change in which recoverability is a factor. This is where at one stage any one of a number of phonological characteristics of a base form may correspond to a single characteristic in derived forms. What makes this situation difficult, from the point of view of the parsing model, is roughly that there are a number of conflicting strategies leading to possibly appropriate base forms, making the one correct base form relatively hard to locate. An example is the development of Polish adjectival forms like those in (8) and (11) above, as discussed by Gussmann (1976). Consider first a simple example. Gussmann cites evidence that the adjective *postny* 'lenten' goes back to an older form *pośny*, which was less transparently related to the noun *post* 'fast' than the new form. From Gussmann's point of view, this development at first seems puzzling, since it increased the opacity of C Drop (7) by creating a new exception to it. But Gussman explains the example by suggesting that forms change to increase the recoverability of the underlying form from the surface form. We can adjust this statement to say that the adjectives changed to facilitate recovery of their relationship to corresponding nouns. Prior to the change, Polish not only had adjectives in *-śn-* related to nouns in *-st*; it also had adjectives in *-śn-* related to nouns in *-s* (e.g. *gło[s]* 'voice' / *gło[śn]y* 'loud'; *sko[s]* 'obliqueness' / *sko[śn]y* 'oblique') and some in *-śn-* related to nouns in *-ść* (see below). What made this situation difficult for speakers is roughly that from looking at a given surface form in *-śn-* one could not immediately tell whether the noun it was related to would end in *st*, *s*, or *ść*. The change of *pośny* to *postny* helped to rectify the recovery problem by removing one class of bases that previously had adjective forms in *-śn-*.

One might resist such an explanation, citing a simpler one which would say that the fossilized *pośny* was simply lost, having been supplanted by the productively derived *postny*. (A parallel development in English would be the gradual replacement of *ferocity* by the productively derived *ferociousness*.) But this interpretation will not work in general. Consider the development of a form like *rado[śn]y*, which is morphologically related to *radość* (cf. (11)). In Old Polish, according to Gussman, this form was *rado[śn]y*. We cannot explain this development as a replacement of the old form by a productively derived new one. Adding *-n* and an inflectional ending to the noun *radość* would give *radośćny*. The *ć* would convert to *t* by anterior depalatalization, which Gussman formulates as (13):

(13)

$$\left[\begin{array}{c} \text{C} \\ -\text{cont} \end{array} \right] \longrightarrow [-\text{high}] / \text{---} [+ \text{cor}]$$

and preceding *ś* would follow suit, becoming *s* by a rule making a coronal spirant agree with a following nonpalatal cluster in palatality. Thus we would expect *radostny* instead of the attested *radosny*. This case is also difficult to explain as a haphazard analogical development. The obvious analogical pattern for the adjectival form of *radość* to fit is exemplified by *zawiść_N/zawistny_A*. This, too, would incorrectly predict *radostny*.

As Gussman observes, this case looks problematic from many angles. It increases the opacity of the rule palatalizing spirants before adjectival morpheme *-n*, since where we used to have [*śn*], we now have [*sn*]. By the same token, the rules of Palatal Assimilation and C Drop, which formerly in a non-bleeding order (giving *radost'-n-y* → *radoś'-n-y* by Palatalization and then *radoś-n-y* by C Drop) now apply, in Gussman's analysis, in bleeding order: first *radost'-n-y* changes to *rados-n-y* by C Drop, and then the environment for Palatal Assimilation is no longer met. Furthermore, the change has increased allomorphy. Previously the noun stem within the adjective invariably appeared as *radoś-*, regardless of case endings. Now the noun stem within the adjective is either *rados-* (as in *radosny*) or *radoś-* (as in *radośni*, nom. pl. personal, where *s* has assimilated in palatality to *n*), depending on the case ending.

This development provides particularly strong evidence for the recoverability principle, simply because other commonly used explanations fail. As was mentioned earlier, along with adjectives in *-śn-* related to nouns in *-ść*, Polish had adjectives in *-śn-* related to nouns in *-s* (e.g., *gło[s]* 'voice' / *gło[śn]y* 'loud'). Thus, even though Old Polish *radośny* was perfectly parsable as the adjectival form of *radość*—the rule of C Drop is simply undone, restoring the coronal segment (in this case *ć*) between *ś* and *n*—the situation was relatively difficult for speakers because from looking at a given surface form in *-śn-* one could not immediately tell whether the related noun would end in *s* or *ść*. By changing the adjectival forms of nouns in *-ść*, Polish rectified the recovery problem. I will return to this example below. Note for now that the changes *pośny* > *postny* and *radośny* > *radosny* show that the older derived forms were not simply treated as frozen relics of the past. It is only because their structure was perceived and because the recovery

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7. RECOVERABILITY: A REFINEMENT

The notion of recoverability introduced in the preceding section can be interpreted as influencing a language to change so as to facilitate the process of finding an appropriate base word A to compare against a given derived word B with respect to some morphological rule R. Recoverability is enhanced to the extent that the grammar minimizes the number of paths that lead back from a lexical representation to more abstract representations.

In this section I will address one problem that arises out of the recoverability principle when it is phrased as vaguely as I have put it here. We must distinguish the Polish situation from others which, though parallel in certain respects, do not exhibit the pressure for change that the Polish forms have undergone. A good example comes from a few classes of English adjectival forms in *-ive* and nominalizations in *-ion*. If an adjectival form ends in *-[s]ive*, the [s] can be related to one of the following segments:⁶

- (14) [s] express/expressive; obsess/obsessive
- [z] abuse/abusive; effuse/effusive
- [t] permit/permissive; subvert/subversive
- [d] explode/explosive; evade/evasive

For nominals in *-[s]ion* we have related verbs that end in the following segments:⁷

- (15) [š] abolish/abolition; admonish/admonition
- [s] confess/confession; impress/impression
- [t] assert/assertion; assimilate/assimilation
- [d] apprehend/apprehension; suspend/suspension

These alternations look parallel to the ones in Polish, in that a single phoneme in derived forms—[s] in (14) and [š] in (15)—corresponds to any one of a number of phonemes in a related base word. The recoverability principle, as stated for Polish, would pressure English to eliminate some of these possible sources of [s] in *-[s]ive* and of [š] in *-[š]ion*. In the absence of any sign that this pressure is being felt, we must some-

how distinguish the English alternations from the Polish ones. Interestingly, for the English alternations but not for the Polish ones it is possible to construct an orderly chain of segments that are successively tried in searching for an appropriate base word. For the examples in (15), the case in which [š] comes from a verb in [-š] is the simplest: to relate *abolition* to *abolish* no rules need be undone, except possibly for the stress rule.⁸ For the cases in which this does not lead to a correct base word, the next segment to try is [s], which involves the smallest number of changes from [š] of the group listed in (15); from here the closest segment is [t], and from [t] we go back to [d]. Thus we can posit a sequence of rules which gradually take the segment [s] back to [d], through stages with attested alternants of [š]:

- (16) š ← s
 s ← t
 t ← d

I have omitted environments from these rules, but a full account must express them, to preclude application in environments where no alternation is possible while permitting them to apply in environments other than *-ion*, as illustrated by *space/spacious* and *pirate/piracy*.

The forms in (14) can be related in similar fashion. Before the adjectival ending *-ive* a preceding consonant is always voiceless. This regularity can be built into the morphological rule, so that it specifies not only that the suffix *-ive* is attached but also that the preceding consonant is devoiced. As a result base words in [s] and [z] are recovered without undoing any rules of segmental phonology. For the remaining forms we need a phonological operation taking *s* and *z* back to *t* and *d*. The second rule in (16), which need not refer to voicing since it does not adjust this feature, will perform this function nicely.

By contrast, in Old Polish recovery of *głos* from *głośny* and of *radość* from *radośny* cannot be undone in a uniform chain of steps, as can be seen by comparing the two derivations below:

(17)	Word A	Word B	Morphology
LEXICAL FORMS:	głos _N	głośn-y _A	[Stem - Ending] _N
			→ [Stem - n - Ending] _A
i. Palatalization before -n	—	głosn-y _A	—

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i. C Drop

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LEXICAL FORMS radość_N radośn-y_A [Stem-Ending]_N
 → [Stem - n - Ending]_A

i. C Drop — radoś [+ C / COR] n-y_A —

For *głośny* we undo the rule palatalizing a consonant before adjectival affix *-n*. Having recovered [s], we see that the environment for the morphological rule is now satisfied by this adjective and the noun *głos*. But for *rado[s]ny*, there is no possibility of undoing the palatalization rule. By condition (2c), rules are undone only when they increase the compatibility of two forms with respect to a morphological rule. Palatalization would not qualify in this case since the noun *rado[sć]* has [ś] exactly where the adjective has it. Similarly, condition (2c) prohibits us from rewriting *radość* as *rado/st-ĩ*, since this would make this form less similar to *radośn-y*. Conversely, note that it is impossible to employ C Drop, which is the first rule successfully undone in (18), as the first rule in (17). By condition (2c), this step is impossible, since inserting a consonant after [ś] in *głośny* would make it less similar to *głos*.

The absence of a chain of successfully applied steps does not make recovery impossible, but it does make it more difficult. When the forms described above changed, the result aided recovery of the segments in question. In modern Polish, [ś] is simply taken back to [s]; [s] is simply taken back to [st].

The principle suggested here, that recovery is hindered when there is more than one path that can be followed in taking a segment in a derived word back to a representation compatible with the corresponding segment in a base word, successfully differentiates the Old Polish situation from the English one. But it remains to show that the difference cited is a relevant one. One thing that suggests that it is is that some English forms breaking an established chain of rules have been changing in a way that we would predict. As noted by Leben and Robinson (1977), forms like *caprice/capr[i]cious* and *prestige/prest[i]gious* do not exhibit the normal vowel alternations.⁹ Where [i] alternates with a lax vowel, that vowel is usually [e], as in *serene/serenity*, and where [i] alternates with a tense vowel, that vowel is normally [ü], as in *vice/vicious*. Now, despite this fact, forms like *capricious* can still be successfully parsed by the rules that undo the vowel alternations in *serene/serenity*, *vice/vicious*, etc., as shown here:

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(19)	Word A	Word B	Morphology
LEXICAL FORMS:	kəprɪjs _N	kəprɪʃəs _A	[X] _N → [X - ɪjəs] _A
i. Glide deletion e.g. j → Ø / s _____	—	kəprɪʃjəs _A	—
ii. Palatalization e.g. s → ʃ / _____ j	—	kəprɪsjəs _A	—
iii. ɪ → Ø / C _____ y	—	kəprɪʃjəs _A	—
iv. (Vowel Shift)	—	—	—
v. Diphthongization	kəprɪs _N	—	—
vi. Trisyllabic shortening	—	kəprɪsɪjəs _A	—

But in order to recover /ɪ/ from /i/, we have bypassed the rule of Vowel Shift, by condition (2c). This breaks the established chain of rules, pointing to a recovery problem under the principle proposed above. Innovative forms *capr[ij]cious* and *prest[ij]gious* solve the recovery problem by eliminating the vowel alternation altogether.

The case just examined, I think, points up a very interesting consequence of the parsing approach. Where previous approaches to morphophonemics dealt with one type of exception feature, the present model in effect says there are two. One kind, involving lexically governed differences in rule application as in *obese/obesity* vs. *serene/serenity*, *solo/soloist* vs. *cello/cellist*, *zawiśc/zawistny* vs. *radośc/radosny*, have resisted change, at least partly because they have posed no recovery problem under the definition given here. The other kind, again involving a lexically governed difference in rule application, exemplified by *caprice/capricious* vs. *vice/vicious*, has been noticeably more susceptible to change. If this result is at all general, it will indicate that the parsing model brings us closer to an explanatory theory of morphophonology than previous approaches. Note that the suggested difference between the two sorts of exception is here a principled one, in that the difference follows automatically from the interaction of the recoverability principle with the conditions on well-formed derivations, including the rules and the conventions on rule application.

This account makes crucial use of the characteristic, inherited through the evaluation metric of standard generative phonology, of sometimes factoring complex alternations into a sequence of simple ones, as illustrated by the rules in (16) and the derivations (6) and (19). To reject

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this possibility at present would, as far as I know, require sheer dogmatism. If the account proposed here is correct, it provides new empirical support for maximizing the simplicity and range of applicability of rules.

The recoverability principle serves one more important function, that of helping to explain why it is that the rules of the parsing model are not more general than they might otherwise be. To see this, recall that parsing rules are not redundancy rules. Trisyllabic Shortening, for example, cannot be interpreted as a redundancy rule, since it is violated by *obesity*, *notify*, etc. But since parsing rules only specify what *can* be done in some derivations rather than what *must* be done in all derivations, this leaves open the possibility of making these rules absurdly general. For example, Trisyllabic Shortening could be stated without any environment, though it would only happen to apply fruitfully in a few environments, most of them trisyllabic. Or the Truncation rule for *cellist* could be re-expressed as $V \rightarrow \emptyset$, with no environment, and this rule could now be collapsed with rules deleting consonants and glides. The recoverability principle provides a sensible way of avoiding these absurdities. To the extent that a rule is overly general, it will potentially define steps in derivations that must never be taken, leading to a large-scale recovery problem. Hence the recoverability principle limits the generality of the rules.

I conclude that even with a substantial set of limitations on the phonological content of lexical representations, it is possible to construct a systematic and theoretically interesting account of alternations which, though not productive in the usual sense, exert an influence on linguistic change.

NOTES

This paper is a revision of a paper presented at the Conference. The revision was prepared while I was on sabbatical leave in the Department of Linguistics and Philosophy at M.I.T. I wish to thank the Department for making its resources available to me. I am particularly grateful to Joan Bresnan, Edmund Gussman, James Harris, and Paul Kiparsky for thoughtful challenges and suggestions based on an earlier version of this paper and to Noam Chomsky and Morris Halle for comments which, while not always sympathetic, have been most helpful.

1. To simplify the exposition I state these conventions in a way that makes parsing rules easier to relate to rules familiar from conventional generative

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phonology. The appearance that the actual rules in a parsing model are arrived at by first doing a standard generative analysis should be ignored. In particular, Robinson (to appear) shows that the procedures outlined here permit one to simplify ordering statements. Furthermore, as rule (4) in fact illustrates, phonological rules in the parsing model are sometimes formulated more generally than in a conventional generative account. For discussion of a principle constraining the generality of rules, see section 7.

2. Rubach (1977:130-135) observes that the rule, taken as a fast speech rule, is more general. He gives it the following formulation:

$$\begin{bmatrix} -\text{cont} \\ -\text{del. rel.} \\ +\text{cor} \\ +\text{ant} \end{bmatrix} \longrightarrow \emptyset / \langle C \rangle \begin{bmatrix} +\text{obstr} \\ +\text{cor} \end{bmatrix} - \begin{bmatrix} +\text{cons} \\ \langle +\text{cont} \rangle \end{bmatrix}$$

But this creates no problem for employing it as a parsing rule, as in derivation (12) in the text, since this more general formulation will, by virtue of including (7) as a sub-part, still be able to restore *t* in all of the places in which it is called for.

3. Gussmann (to appear) proposes that the adjectival suffix is not *n* but rather *Vn*, where *V* is some vowel that has a raising effect on the vowel of the preceding syllable. The existence of this effect is demonstrated by the last pair in (10), *gwiazda/gwiezdny*, in which the vowel *a* of the noun corresponds to the vowel *e* of the adjective. I accept this proposal but, to simplify matters, will ignore it in the text.

4. Gussmann (1976 and to appear) handles this fact by regarding [šć] as a reflex of /stʃ/. Under this proposal we arrive at the stem of nouns in -šć in the same way as for other nouns, by deleting the final vowel. I will accept this proposal for expository purposes but must note that, despite the abundant morphophonological evidence for it in Gussmann (to appear), it involves manufacturing a tense/lax contrast that, as far as I know, is never manifested as such on the surface in Polish. Furthermore, tests that one might apply in order to verify the presence of the vowel of /stʃ/ as an actual vowel seem unlikely to support this proposal. For example, the putative final /ʃ/ does not make the preceding syllable count as penultimate for the purposes of the penultimate stress rule.

5. The proposal that these adjectives are listed lexically rather than all being productively derived is corroborated by the fact, noted by Gussmann, that some of them differ unpredictably in meaning from their corresponding nouns. For instance, the adjective corresponding to 'fear' is glossed as 'terrible', and the one corresponding to 'foetus' is glossed as 'fertile'.

6. In addition to these, words in -[s]ive can contain allomorphs that are peculiar to one morpheme. In instances like *cohere/cohesive*, we are not really dealing with an alternation between [r] and [s], and in *compel/compulsive* we are not dealing with a relation between \emptyset and [s]. Rather, as Aronoff (1976: 109) has proposed, in *cohere/cohesive* we have relations between allomorphs /hɪr/ and /hɪz/ (/z/ becomes [s] before -ive, as noted later in the text); similarly for /pel/ and /pʌls/. A sign of this is that other

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instances of the same morpheme will tend to exhibit the same alternation (as with *adhere; impel, repel*), but other morphemes ending in the same segment will tend not to exhibit this alternation. The situation is quite different with the examples in (14).

7. In addition, there are cases that involve allomorphy either of the root or of the suffix—it is not clear which: cf. Aronoff (1976: 104), who cites as examples *define/definition, repeat/repetition*. Morphemes like *-here* and *-pel*, mentioned in fn. 6, also change before *-ion*.

8. It may not even be necessary to undo the stress rule for the forms in (15), since the stress difference can be built into the morphological rule: stress is invariably on the syllable preceding the ending *-ion*. This seems a good way to say that stress is morphologized in such cases, as many have claimed.

9. The original observation, I have found, stems from J. D. McCawley, cited in an obscure footnote in Ross (1972).