

ENGLISH PHONOLOGY AND MORPHOLOGY:
SOME REVISIONS AND SUGGESTIONS*

PIOTR RUSZKIEWICZ

University of Silesia, Katowice

Writing about the developments in the theory of generative grammar, it has been customary for linguists to establish certain caesuras by which the theory as a whole or at least selected aspects of it assume a relatively well defined shape. In syntax it is the *Aspects* (1965) model that has long been referred to as the standard model. In phonology the relevant caesura came three years later and came to be associated with the monumental *Sound pattern of English* (henceforth SPE) by Chomsky and Halle (1968).

Standard theories are extremely interesting from the standpoint of the subsequent developments which grew out of them or arose as reactions to certain proposals contained in the standards. Also of interest are applications of the available standard theories to the description of other languages than those which provided the data for their construction. Since the present paper purports to concentrate on selected aspects of the relation between phonology

* The principal tenets underlying the present paper were presented at the April 1981 meeting of the Linguistic Circle of the Department of English, University of Silesia. I would like to thank all those of my colleagues who raised a number of interesting questions during the meeting and in private discussion afterwards. I am especially indebted to Charles Wukasch for reading an earlier draft of this paper and for making a number of stylistic improvements. Also my sincere thanks are due to Professor Roman Laskowski of The Polish Academy of Sciences, Cracow, for a number of helpful comments. Last but not least, I would like to express my gratitude to all the students of my 1979/80 phonology class, University of Silesia, who were patient enough to listen to my then highly unsatisfactory formulations and for helping to polarize my position. For any shortcomings of the work, I alone am responsible.

and morphology as they appear in the standard theory of phonology and in some of the post-standard developments, not much will be said about syntax.

Anderson (1979) makes the following lucid statement to characterize the phonological program of SPE: "In the program of SPE, essentially all operations on sound structures are performed by phonological rules, which in turn are freely allowed to contain morphological conditions without entailing a significant difference between rules that do and rules that do not involve such non-phonological information" (p. 11).

Subsequent research into the phonologies of particular languages has brought forth firm evidence that morphologically conditioned rules and purely phonological rules differ in a number of important respects. They can be briefly described as precedence of morphological rules over phonological rules, subjection of (genuine) exchange rules to morphological conditions, a difference in interpreting variables (especially the X_0 notation of SPE) by the two categories of rules and the restriction of the principle of simultaneous application to morphologically conditioned rules (for details see Anderson 1979:11 ff.).

In contrast to the pre-generative theories of language which recognized the separateness of morphology, morphology was largely ignored in the first decade of the development of generative grammar. Interest in morphological phenomena was awakened towards the late 1960s, especially after the publication of SPE in 1968. The status of inflectional morphology was examined by Bierwisch (1967), this being followed by studies on derivational morphology. It is now almost commonplace to say that a morphological description of a language which aspires to be complete must account for both aspects, the inflectional and the derivational. A detailed discussion of two approaches to morphology developed in the 1970s, Halle (1973) and Jackendoff (1975), can be found in Laskowski (1977). Two other interesting works on (English) morphology can be mentioned at this point: Siegel (1974) and Aronoff (1976).

I now wish to discuss in more detail the last two works. Both Siegel (1974) and Aronoff (1976) recognize that inflectional morphology and derivational morphology are distinct but related phenomena. Siegel's contribution to (English) morphology lies in the fact that she manages to provide convincing arguments in support of the claim that the three boundaries of SPE, +, # and =, can be reduced to two, + and #. Consequently, the English affixes have been shown to fall into two categories: those which contain the + boundary (Siegel's Class I affixes) and those which contain the # boundary (her Class II affixes). Furthermore, Class I affixation is shown to precede Class II affixation, with the stress assignment rules intervening between the two. As a result, some of the transformational phonological rules of SPE have been shifted from the phonological component to the lexicon. The latter move has in turn made it possible to lift global constraints on some of the Class II affixation processes which in earlier accounts required access to information on stress assignment

which was available only after the transformational phonological rules had applied.¹

Aronoff's (1976) approach to morphology clarifies the distinction between regular and irregular morphological phenomena. To account for the regular phenomena, Aronoff develops a theory of *word-based morphology* in which word-formation rules perform operations on words (called *bases*) to form new words.² Word-formation rules actually do three different things: (a) specify a unique phonological operation performed on the base, (b) specify a syntactic label and subcategorization for the word produced, and (c) specify a semantic reading for the output. The latter is said to be compositional, i.e., it is a function of the meaning of the base and the structure of the resulting word. Generating new words is one major function of word-formation rules and the same rules can also function as rules of word analysis. In this function, they analyse morphologically complex words into constituents though the words may not be "strictly generable from these constituents" (Aronoff 1976:31).

As for the relation of morphological rules to phonological rules, Anderson (1979:17) mentions a generally valid principle according to which "morphological rules precede rather than follow phonologically conditioned ones". Aronoff (1976) has refined this statement and comes to the conclusion that "morphological operations can take place at certain very specific places in a phonological

¹ When Siegel talks about stress assignment rules, she means the kind of mechanism as was proposed by Chomsky and Halle (1968) or later revisions thereof, especially Halle's (1973) new system of rules. In 1977 Liberman and Prince came forward with new proposals on how to integrate stress with syntactic structure without making use of the cycle in the Chomsky-Halle sense. Anderson (1979:15), commenting on their approach, states that the device of the cycle could probably be completely dispensed with. Later discussion in *Linguistic Inquiry* (Vol. 10 Number 3 and Vol. 11 Number 3) argues for the general validity of Liberman and Prince's approach, excluding perhaps Anderson's suggestion concerning the utility of the cycle. In particular, Kiparsky (1979), referring to Liberman and Prince (1977), emphasizes the importance of the cycle for matrical structure assignment and, consequently, for stress assignment.

² Aronoff's word-based hypothesis has been challenged by Laurie Bauer (1979), who presents lists of neologisms derived from Barnhart, Steinmetz and Barnhart (1973) which allegedly call into question Aronoff's (1976:21) fundamental assumption that "All regular word-formation processes are word-based. A new word is formed by applying a regular rule to a single already existing word." The characteristic feature of Bauer's counter-examples is that they are made up of affixes alone (i.e., they do not involve roots) and that as neologisms, they are productive. This strongly suggests that not all new words are formed from already existing words. Bauer's examples are no doubt worth examining, but they merely weaken Aronoff's hypothesis rather than disprove it completely since the hypothesis is worth retaining even if an overwhelming majority of word-formation processes are word-based. Also, parallel to Chomsky's (1977:127, n. 10) claim that "phenomena do not bear directly on conditions on rules; only rules do", I would like to suggest that phenomena (i.e., counterexamples) do not directly disprove hypotheses; only counter-hypotheses do.

derivation" (p. 80). This means that morphological rules do not have to precede phonological rules; they can follow them. However, the two kinds of rules are believed not to interact. (See, however, Anderson 1979: 17 who refers to Chung and Anderson (forthcoming) to support an opposite hypothesis.)

Chomsky and Halle (1968: 9 ff.) talk about two related concepts of surface structure: as output from the syntactic component and as input to the phonological component. They observe that the two do not always coincide. To remove the discrepancies, they postulate *readjustment rules* whose task is to make the strings generated by the syntactic component fully appropriate for the application of the phonological rules. (Recall that the standard theory of phonology of Chomsky and Halle does not include a morphological component.)

It so happens that in Aronoff's (1976) model of morphology, and most probably in any model of morphology, the output of word-formation rules cannot always be processed by the phonological rules. To cope with this specific problem, Aronoff postulates a set of adjustment rules (see especially Chapter 5 in Aronoff 1976). They are of two kinds: *truncation rules*, which delete designated morphemes before other designated morphemes, and *rules of allomorphy*, which effect phonological changes in specific morphemes which occur in the immediate environment of other specific morphemes (Aronoff 1976: 88, 98, respectively). The introduction of the morphological adjustment rules relieves the phonological rules of the task which they cannot fulfil in a natural way: accounting for morphologically governed alternations. In practical terms, this means getting rid of ad hoc phonological rules (i.e., rules which are designed in such a way as to apply to a very limited set of forms) and rules which effect highly "unnatural" changes.

Among the Polish linguists of the past decade or so who have worked either on English segmental phonology or on contrastive Polish-English (segmental) phonology, it is not uncommon to accept the standard theory of phonology without much dispute. This observation is true of those who have dealt with low phonetic processes (see for instance Rubach 1975a, b; 1976a, b; 1977), the abstractness controversy (see Gussmann, numerous references, especially 1972; 1974; 1975; 1977; 1978; and 1980b), and morphology in general (see especially Gonet's (1979) interesting but also controversial paper). It is obvious that the consequences of adopting the standard theory are much graver in the last two cases than in the first one.

In what follows I wish to concentrate on Gonet's approach, discuss some of its inadequacies and propose alternative solutions. In the course of the discussion I will make reference to the theory of local ordering as formulated by Anderson (several references, especially 1974) and to the theory of word-based morphology of Aronoff (1976), that is, theories which are fairly well known in this country but which have never been exploited in full.

Gonet's (1979) objectives are to establish the underlying representations of English inflectional endings (the discussion covers the regular exponents of the plural, the possessive of nouns, the 3rd pers. sg. present tense indicative mood, the regular exponents of the preterite, the past participle and several types of derived adjectives), to set up a set of phonological rules which will convert them into their corresponding phonetic representations, and to present arguments for choosing between competing proposals concerning both representations and sets of rules. The proposals single out four possible shapes of the endings: syllabic voiceless (/is/, /it/), syllabic voiced (/iz/, /id/), non-syllabic voiceless (/s/, /t/), and non-syllabic voiced (/z/, /d/). In the course of the discussion the representations which contain the voiceless obstruents are excluded with a fair amount of certainty. The decision as to whether to choose the syllabic or non-syllabic voiced is less easy to make. In the case of the endings containing the voiced stop, Gonet seems to favour a solution which proposes the syllabic representation for the derived adjectives and the non-syllabic representation for the verbs.

I now wish to review the sets of rules presented by Gonet to derive phonetic representations from the four possible underlying representations. The rules will be examined from the standpoint of the input-output relations which obtain among them. It will be shown that if Anderson's (1974) theory of local ordering is to be maintained — and I believe there are good reasons to do so — the sets of rules will have to be radically modified, with far-reaching consequences for the shape of the underlying representations.

Gonet does not seem to be favourably disposed towards issues of rule ordering. While commenting on Miner's attempt at experimenting with different modes of the ordering of phonological rules, he states that "issues as complicated as rule ordering hypotheses need first to be examined with deep insight before they can be used as arguments in phonological analyses" (p. 72), and later in the same passage, "we do not know what the relation in terms of simplicity is between a pair of extrinsically ordered rules and the same rules ordered intrinsically".

Contrary to Gonet's position, the present discussion of phonological and morphological phenomena will crucially involve certain ordering hypotheses as arguments.

As is well known, attempts to formulate alternatives to the theory of linear ordering in phonology were developed in response to the inadequacies of the latter. These inadequacies are familiar enough and will not be discussed here. Specifically, I want to refer to the ordering hypotheses as embodied in Anderson's theory of local ordering (see especially Chapter 10 in Anderson 1974). When viewed from the standpoint of input-output relations and the sets of linguistic forms to which they apply, phonological rules clearly fall into two categories: (a) rules which do not interact, i.e., unrelated rules and (b)

rules which interact, i.e., related rules. Rules of type (b) in turn fall into two classes, i.e., those which observe the principle of natural order when they apply, and those which must apply in a counterfeeding order to yield the correct result. For the latter, the order of application must be stated explicitly.

The concept of natural order rests on the input-output relations among rules. Thus, for a given pair of rules, A and B, applied in the order 'A precedes B', a *feeding* relation (order) obtains if the application of rule A increases the number of cases to which rule B can apply. If the application of rule A decreases the number of cases to which rule B can apply, the resulting relation is *bleeding*. If the application of rule A has no effect on the number of cases to which rule B can apply, the relation is *neutral*.

Given a pair of rules, A and B, either A can precede B or vice versa. However, in terms of input-output relations, the two orders of application may, but need not, be different. The notion of natural order can be defined as follows: "where only one of the two possible orders for a given pair of rules is feeding, the feeding order is the natural one; ... where only one of the two possible orders is bleeding, the other order is the natural one. In all other cases (i.e., when both possible orders are of the same type) no natural order is (yet) defined" (Anderson 1974:147).

Since in any particular language the (related) rules which defy the principle of natural order constitute a relatively small percentage of the total number of rules (this follows from the well-established principle of "the preference of languages for 'feeding' orders," Anderson (1979:16)), it is only for this subset of rules that the order of application will have to be stated explicitly. There is nothing to be said about the order of rules which do not interact. Also, nothing needs to be said about those rules which apply in the natural order. The principle of natural order can thus be elevated to the status of a metatheoretical statement and, given its generality, may be considered a linguistic universal.

Given an outline of the theory of local ordering, let me proceed to a discussion of how this theory can bear upon the choice of underlying representations and phonological rules. On the assumption that the underlying representation (UR) of the inflectional endings is syllabic voiceless, Gonet (1979:66, 69) sets up three phonological rules to derive the corresponding phonetic representations (PR) (his representations and rules are repeated below as (1)):

(1) UR:	/is/	/bit#is/	/pig#is/	/boy#is/	/kis#is/
deletion		∅	∅	∅	
voicing I			z	z	
voicing II					z
PR:	[bits]	[pigz]	[boyz]	[kisiz]	

Leaving aside the problem of the exact formulation of the above rules, let me state the input-output relations as they obtain between pairs of rules formed from the three rules given in (1).

- (2) a. The order 'deletion precedes voicing I' is feeding; the opposite order is neutral. Thus the order 'deletion precedes voicing I' is natural.
 b. The rules voicing I and voicing II do not interact.
 c. The order 'deletion precedes voicing II' is bleeding; the opposite order is neutral. Thus the latter is the natural order.

It follows that if languages do in fact display a preference for feeding orders, the three rules under consideration should be ordered as in (3):

- (3) Voicing II precedes deletion which in turn precedes voicing I.

Given the fact that voicing II applies before the other two rules, and also considering the fact that the rule in question has been designed so as to voice the desinential obstruent in forms such as /kis#is/ in (1) above, it appears that voicing II will apply to all the forms specified in (1). This in turn obviates the need for voicing I but, simultaneously, a rule of devoicing will be required, superseding the rule of voicing I in (3). In effect, the rules which will be arrived at are those in (4), to be applied in that order:

- (4) Voicing II precedes deletion which in turn precedes devoicing.

Consider now the implications that the scheme in (4) carries with it for the form of the underlying representation of the relevant endings. The application of voicing II will in fact convert every instance of /#is/ into /#iz/. In view of this, one might as well postulate the latter as an underlying representation. This move would obviously eliminate the need for voicing II and the set of rules would be reduced to two, as in (5):

- (5) Deletion precedes devoicing.

Thus, following the principles of the theory of local ordering, we have arrived at the conclusion that the underlying representations of both the regular plural ending and the regular ending of the 3rd pers. sg. should be syllabic voiced rather than syllabic voiceless, and the rules that derive the corresponding phonetic representations are deletion and devoicing, applied in that order. Since the order 'deletion precedes devoicing' is feeding for the relevant set of forms, the opposite order being neutral, we conclude that the order 'deletion precedes devoicing' is natural. The conclusions reached fully accord with the tenets of the theory of local ordering. Also, they coincide with the third possibility discussed by Gonet (1979:67, 70), though he does not use arguments which hinge on ordering relations to any considerable extent. It follows that syllabic voiceless is not a plausible underlying representation for the endings discussed so far.

Another candidate for the underlying representation is /s/, i.e., non-syllabic voiceless (cf. Gonet 1979:66, 70—71). The rules which Gonet presents to effect the required mapping are as follows (his representations and rules are repeated below as (6)):

(6) UR: /s/	/bit #s/	/pig #s/	/boy #s/	/kis #s/
insertion				i
voicing I		z	z	
voicing II				z
PR:	[bits]	[pigz]	[boyz]	[kisiz]

Input-output relations will be examined as before, with the exception that the rule of insertion will require more attention than the remaining ones. This is because the vowel /i/ can be inserted at three different places in the strings of the /kis #s/ type. To illustrate this, let me first observe that, given the standard assumptions, the full representation of the last string will be [#kis #s]N. This follows from the well-known convention of Chomsky and Halle (1968:12—13) according to which “each lexical category (e.g., noun, verb, adjective) and each category that dominates a lexical category (e.g., sentence, noun phrase, verb phrase) automatically carries a boundary symbol # to the left and to the right of the string that belongs to it” (in the literature this convention is referred to as SPE-I, cf., e.g., Selkirk 1972, Siegel 1974). On the Siegel (1974:97) analysis of English inflectional phenomena, the plural marker, in its regular behaviour, is rewritten as /#s/. Thus, the form of the string [#kis #s]N is fully accounted for.

One might attempt to simplify the representation given above by applying the convention proposed by Selkirk (1972:12) which is known under the label of SPE-II:

(7) In a sequence W#[X#]YZ or WY#[X#]Z, where Y ≠ S', delete the “inner” word boundary.

The net effect of applying (7) to the case in question is (8):

(8) [#kis #s]N

Since the rules of segmental phonology disregard labelled brackets, (8) can be further represented as (9) or (10):

(9) [#kis #s #s]N
 (10) /#kis #s #s #/

Returning now to the vowel insertion rule, depending on its formulation three different outputs are possible:

- (11) a. /#kis #is #/
 b. /#kis #i #s #/
 c. /#kisi #s #/

Since, disregarding the details of rule formulation, there is not much difference between (11a) and (11b) from the standpoint of how the two rules of voicing mentioned in (6) apply, I will only examine the ordering relations as they obtain between the rule of insertion and the rules of voicing for only two possible outputs of the rule of insertion, for instance (11a) and (11c):

- (12) a. The insertion rule produces /#kis #is #/ as its output: The order ‘insertion precedes voicing I’ is bleeding; the opposite order is neutral. Thus the order ‘voicing I precedes insertion’ is natural.
 a'. The insertion rule produces /#kisi #s #/ as its output: The order ‘insertion precedes voicing I’ is neutral; the opposite order is also neutral. Thus no natural order can be stated for the two rules.
 b. The rules of voicing I and voicing II do not interact when the output of the insertion rule is (11a) or (11b). The rule of voicing II is redundant when the output is (11c).
 c. Regardless of whether the output of the insertion rule is (11a) or (11b), the order ‘insertion precedes voicing II’ is feeding; the opposite order is neutral. Thus the order ‘insertion precedes voicing II’ is natural.

With regard to (12a') it is interesting that, although no natural order can be defined for it, the case is very instructive. Thus, when voicing I precedes insertion, voicing I applies vacuously to strings like /#kis #s #/. The insertion rule then produces as its output the string /#kisi #s #/, which is incorrect. The correct string obtains only after voicing I has reapplied, implying that the plausible order is ‘insertion precedes voicing I’. The latter ordering obviates the need for the rule of voicing II, whereas in (12a) the rule of voicing II is required.

The cases for which natural order can be defined, i.e. (12a) and (12c), suggest the following order of the rules under discussion:

(13) Voicing I precedes insertion which in turn precedes voicing II.

Consider briefly the nature of the rules in (13). Voicing I is a rule which voices a desinential obstruent by making reference to the last segment of the preceding formative across double (##) word boundary. In one of its formulations, the rule of insertion inserts a vowel to the right of ##, before the segment /s/. Both voicing I and insertion are phonological rules. Voicing II voices the segment /s/ in the context #i—#, but is obviously a strange kind of rule. It resembles the lexical redundancy rules of Chomsky and Halle (1968:171) in that it does not apply across morpheme boundaries (Chomsky and Halle's position on the lexical redundancy rules is that “they belong to the system of readjustment rules rather than to phonology,” p. 171. Also

see Hooper 1975 for a discussion of the status of lexical redundancy rules.) On the other hand, the rule in question cannot be considered a lexical redundancy rule since, rather than fill in an unspecified cell, it changes the value of the feature voice. The role of voicing II in the derivation of the voiced allomorph seems to consist in accomplishing what the preceding rules are unable to do. This strongly suggests that, given the underlying representation /s/, the purely phonological rules are unable to derive the required phonetic representations. *Ipsa facto*, /s/ is not a plausible underlying representation.

The discussion so far has led us to the conclusion that syllabic voiced should be preferred to syllabic voiceless, and non-syllabic voiced to non-syllabic voiceless. The motivation in each case is slightly different. Thus it is not true that the arguments that rule out syllabic voiceless as an underlying representation automatically carry over to non-syllabic voiceless (see Gonet (1979:70) who subscribes to the opposite view). Before arguments are given for choosing between syllabic voiced and non-syllabic voiced, let me discuss the plausibility of the latter.

As earlier, let me repeat the relevant derivations from Gonet (1979:67):

(14) UR:	/z/	/bit #z/	/pig #z/	/boy #z/	/kis #z/
insertion					i
devoicing		s			
PR:		[bits]	[pigz]	[boyz]	[kisiz]

The ordering relations holding between insertion and devoicing are stated in (15):

- (15) The order 'insertion precedes devoicing' is bleeding (on the assumption that the vowel /i/ is not inserted to the left of # # (= # in Gonet's interpretation); the opposite order is neutral. However, in the orthodox formulation of the rule of devoicing, this order produces an incorrect result. Therefore, the two rules must apply in a counter-feeding order.

The conclusion reached in (15) does not directly violate the theory of local ordering because the theory does allow a (relatively small) subset of rules to apply in a counter-feeding order and, as a result, for these rules the order of application must be stated explicitly. Simultaneously, however, one might call attention to the tendency of languages to maximize natural order and argue in favour of syllabic voiced as the underlying representation since the rules discussed in connection with the latter do not violate this tendency.

Consider now that part of my statement in (15) 'in the orthodox formulation of the rule of devoicing,' by which I mean, for instance, the following (in accord with the remarks above, the environment should in fact be stated

as [-voice] # # — #):

- (16) [+obstruent] → [-voice] / [-voice] # — #

Rule (16) appears, for instance, in Anderson (1974:58) and Gussmann (1980a:83), Gonet's (1979:70) rule:

- (17)
$$\left[\begin{array}{l} -\text{sonorant} \\ +\text{coronal} \\ -\text{distributed}^3 \end{array} \right] \rightarrow [-\text{voice}] / [-\text{voice}] \# \text{---} \#$$

differs from the formulation in (16) in that the specification [—sonorant] is used to designate the class of obstruents and in that the specification $\left[\begin{array}{l} +\text{coronal} \\ -\text{distributed} \end{array} \right]$ is in fact redundant. This follows from the fact that, depending on the inflectional marker, the relevant rule introduces in the dash position of the environment no other obstruents but /z/ or /d/.

Of course, a non-orthodox formulation of the rule is also possible. Suppose that the rule were formulated in such a way as to capture the generalization expressed in (18):

- (18) The endings marking, among other things, the regular plural and the regular past tense contain a voiced obstruent whenever the word they attach to ends in a voiced segment or in a $\left[\begin{array}{l} +\text{distributed} \\ +\text{coronal} \end{array} \right]$ obstruent which in turn exhibits agreement with the desinential obstruent in terms of the feature strident. In the latter case, a vowel intervenes between the desinential obstruent and the word attached to, which process is taken care of by a separate rule.

The generalization expressed in (18) is captured by the following rule:

- (19)
$$[-\text{son}] \rightarrow [b \langle \text{---} \rangle -\text{voice}] / \left[\begin{array}{l} -\text{voice} \\ +\text{cor} \\ -\text{son} \\ +\text{dist} \\ \text{a} \langle \alpha \text{ strid} \rangle \end{array} \right] \# \left[\text{a} \langle \alpha \text{ strid} \rangle \right] \#$$

Condition: if *a*, then *b*.

That part of the generalization stated in (18) which refers to the presence of an intervening vowel can be accounted for by rule (20):⁴

³ See note 5 below for comments on the use of the feature [distributed].

⁴ Gonet (1979: 71, 72) presents two rules of vowel insertion, R-5 INSERTION and R-6 INSERTION, repeated below as (i) and (ii), respectively:

- (i)
$$\phi \rightarrow i / \left[\begin{array}{l} +\text{coronal} \\ +\text{obstruent} \\ \alpha \text{strident} \\ \beta \text{del. rel.} \end{array} \right] \# - \left[\begin{array}{l} +\text{coronal} \\ +\text{obstruent} \\ \alpha \text{strident} \\ \beta \text{del. rel.} \end{array} \right] \#$$

$$(20) \quad \emptyset \rightarrow \begin{bmatrix} +\text{syll} \\ +\text{high} \\ -\text{back} \\ -\text{tense} \end{bmatrix} / \begin{bmatrix} +\text{cor} \\ -\text{son} \\ +\text{dist} \\ \alpha\text{strid} \end{bmatrix} \# \text{---} \begin{bmatrix} +\text{cor} \\ -\text{son} \\ +\text{dist} \\ \alpha\text{strid} \end{bmatrix} \#$$

Remark: In the right-hand column of the environment, the specifications [+cor] and [+dist] are redundant. They have been included here for the reader's convenience only.

Thus, the rules of devoicing and insertion have been reformulated in such a way that the problem mentioned in (15) no longer arises. That is, in the present formulation of the rules, the order 'devoicing precedes insertion' is neutral and the opposite order is bleeding; therefore the former is the natural one.

Observe that the bleeding effect of (20) on (19) is such that it makes the condition accompanying (19) useless: it can never be met. This is due to the fact that the α part of the condition in fact incorporates the environment part of rule (20).

The same ordering relations obtain if the environments of rules (19) and (20) are stated as (21) and (22) respectively:

$$(21) \quad \begin{bmatrix} -\text{voice} \\ +\text{cor} \\ -\text{son} \\ +\text{dist} \\ \alpha \text{ strid} \end{bmatrix} \# \# \left[\text{a} < \overline{\alpha\text{strid}} > \right] \#$$

$$(ii) \quad \phi \rightarrow i / \begin{bmatrix} \alpha\text{strident} \\ +\text{coronal} \\ \beta\text{continuant} \\ -\text{nasal} \end{bmatrix} \# \text{---} \begin{bmatrix} \alpha\text{strident} \\ +\text{coronal} \\ \beta\text{continuant} \end{bmatrix} \#$$

Rule (i) is identical to Anderson's (1974: 58) rule (8a). It appears that rules (i) and (ii) do not do the same things. In particular, rule (ii) is unable to insert a vowel when the desinential obstruent is a fricative and the word attached to ends in an affricate. This may seem

somewhat surprising since the specification $\begin{bmatrix} \alpha\text{strident} \\ +\text{coronal} \\ \beta\text{continuant} \\ -\text{nasal} \end{bmatrix}$, when viewed in isolation,

does account for affricates. The problem lies in the specification to the right of the environmental dash. The latter can only pick up a desinential fricative (when $\alpha = \beta = +$) or a stop (when $\alpha = \beta = -$). In other words, what the environment part of rule (ii) picks up as a whole depends on what kind of obstruents can occur in the desinence.

Rule (i) picks up the relevant strings only when fricatives are described as [+delayed release]. Although this mode of looking at fricatives is not alien to Chomsky and Halle's (1968) practice (see especially Table 13 on p. 413 in which fricatives along with affricates are specified [+delayed release]), it is at variance with the statement found on page 318 of SPE: "These features [i.e., instantaneous release — delayed release, P. R.] affect only sounds produced with closure in the vocal tract." (Cf. also page 321: "Only sounds pro-

$$(22) \quad \begin{bmatrix} +\text{cor} \\ -\text{son} \\ +\text{dist} \\ \alpha\text{strid} \end{bmatrix} \# \text{---} \# \begin{bmatrix} +\text{cor} \\ -\text{son} \\ +\text{dist} \\ \alpha\text{strid} \end{bmatrix} \#$$

Rules (21) and (22) have been stated so as to apply to strings presented as (10) above and to incorporate the possibility expressed in (11b).

To summarize, the discussion so far has reduced to two the number of possible representations associated with the endings of the regular plural and the 3rd pers. sg. The representations eliminated are syllabic voiceless (/is/) and non-syllabic voiceless (/s/). The feasibility of formulating rules (19) and (20) above shows that the arguments used also carry over, at least partially, to the problems posed by the endings of the preterite and past participle of regular verbs. Nothing has been said about the morphology of adjectives derived by adding the suffix /(i)d/. The arguments used in the discussion crucially involve reference to the theory of local ordering. Two major issues remain to be considered, namely, the question as to which of the two remaining representations, syllabic voiced and nonsyllabic voiced, is the more plausible, and the problem of the relation between, on the one hand, the suffix deriving certain classes of adjectives and, on the other, the preterite and past participle endings appearing with regular verbs.

The rules connected with the non-syllabic voiced representation (/z/) have, it seems, been adequately formalized. To answer the first of the two questions raised above, one should also have access to the formalization of the rules of deletion and devoicing as they apply to syllabic voiced (/iz/). They can be written as (23)⁵ and (24):

duced with closure can have different types of release.") It seems desirable that release features be limited to the class of stops and affricates, as is done for instance in Schane (1973: 28–29), but cf. Anderson (1974: 298).

⁵ Rule (23) appears to be an improvement over Gonet's (1979: 69) Rule-1 DELETION, which for the reader's convenience is repeated below as (i) (important details omitted in the original version have been supplied):

$$(i) \quad \emptyset \rightarrow \phi / \left\{ \begin{bmatrix} +\text{sonorant} \\ -\text{coronal} \\ +\text{distributed} \\ \alpha\text{strident} \end{bmatrix} \right\} \# \text{---} \begin{bmatrix} -\text{sonorant} \\ +\text{coronal} \\ -\text{distributed} \\ -\alpha\text{strident} \end{bmatrix} \#$$

First, in all the rules presented by Gonet which mention the segments /z/ and /d/, they are referred to as [–distributed]. Chomsky and Halle's (1968) approach to the feature [distributed] is summarized in Table 62 of Ladefoged (1971: 102). The specification [+distributed] encompasses bilabials and palatoalveolars; labiodentals and retroflex sounds are classed as [–distributed]. Dentals and alveolars are said to differ in the value for the feature distributed. Since palatograms of the English dentals and alveolars (cf. for instance the excellent palatograms in Jones 1960) show the alveolars to be produced with a longer constriction than that of the dentals, the former should be described as

$$(23) [+syll] \rightarrow \phi / \left\{ \begin{array}{l} [+son] \\ [-cor] \\ (+dist) \\ \alpha strid \\ [+cont] \end{array} \right\} \# \# \text{---} \left[\begin{array}{l} -son \\ -\alpha strid \end{array} \right] \#$$

$$(24) [-son] \rightarrow [-voice] / [-voice] \# \# \text{---} \#$$

The problem which remains is choosing between (25) and (26):

- (25) The underlying representation is non-syllabic voiced and the set of two rules formalized as (19) and (20) (revised as (21) and (22)) above is applied to derive the corresponding phonetic representations.
- (26) The underlying representation is syllabic voiced and the set of two rules formalized as (23) and (24) above is applied to derive the corresponding phonetic representations.

Recall that since rules (19) and (20), as well as rules (23) and (24), apply in a natural order, factors other than ordering relations will have to determine the decision.

Let me start by examining the case in (25). One major objection which might be raised in connection with the fashion in which rules (19) and (20) have been formulated is that part *a* of the condition attached to rule (19) in fact includes an important part of the environment which is present in rule (20). It might be argued that this inclusion crucially involves the unnecessary repetition of certain phonological material. In this connection one might also object that rule (19) states voice assimilation in an unnatural fashion.

With regard to the first of the above-mentioned objections, I would like to observe that the complexity of the formulation of rule (19) buys an important change in the ordering status of the rules of deletion and insertion: a pair of rules which originally applied in a counter-feeding order now apply in a natural order. This gain, I wish to emphasize, is not to be underestimated. Rules which apply in a counter-feeding order require explicit ordering statements which are language-particular; rules which observe the principle of

[+distributed] and the latter as [-distributed]. This solution is followed for instance in Rubach (1976a).

Second, the interpretation of the specifications enclosed between the braces in rule (i) above presents a major problem. The fact that square brackets occur outside the braces implies that for instance the specification [*α*strident] can co-occur freely with any other specification contained between the braces. Thus, if [-strident] redundantly co-occurs with [+sonorant], the vowel deletes only when the desinential obstruent is /z/. There is no way to delete the vowel when the desinential obstruent is /d/, since for this to happen, the feature [+sonorant] would have to co-occur with the specification [+strident], which is impossible. Rule (23) avoids problems of this kind.

natural order require a natural ordering statement which has the status of a metatheoretical statement.

Consider now the objection that rule (19) states voice assimilation in an unnatural way. I wish to argue first of all that naturalness defies the principle of dichotomy; i.e., it is not true that descriptions, rule formulations or configurations are either natural or unnatural. It seems to be the case that there are several degrees of naturalness. The statement of naturalness is no easy matter since naturalness is a function of a number of factors, including the system of distinctive features used. In his important 1967 paper McCawley presents examples of phonological processes which must be viewed as processes of dissimilation when stated in terms of the Jakobsonian distinctive feature framework (in this connection McCawley refers to Jakobson, Fant, and Halle 1951 and some of the earlier works by Jakobson), although they appear to be processes of assimilation when reinterpreted in terms of the system of features proposed by McCawley.

Since one of the rules under discussion involves reference to voicing phenomena, let me dwell a bit longer on the naturalness of the latter. Two rules will be discussed in this connection, intervocalic obstruent voicing, which affects either all the obstruents in a given language or only the plosives or fricatives (for details see Dinnsen and Eckman 1978), and word-final obstruent devoicing which exists, for instance, in Polish. Leaving details aside, the following is a possible rule of intervocalic obstruent voicing:

$$(27) [-son] \rightarrow [+voice] / [+syll] \text{---} [+syll]$$

Rule (27) is a slightly modified version of Dinnsen and Eckman's (1978:6) rule (7c.). Since [+syll] segments are voiced, one might refer, correctly, to the [+voice] specification associated (redundantly) with the [+syll] segments mentioned in the environment part of rule (27), and convincingly argue that the rule describes a highly natural process.

Let us now proceed to the Polish rule of obstruent devoicing. On the Rubach (1975a:133, rule 9) analysis, the rule assumes the shape of (28):

$$(28) \quad [+obst] \rightarrow [-voice] / \text{---} \left\{ \begin{array}{l} \# \# \\ \# [+son] \\ (\#) \left[\begin{array}{l} +obst \\ -voice \end{array} \right] \end{array} \right\} \quad \begin{array}{l} (a) \\ (b) \\ (c) \end{array}$$

Although it appears that (28c) alone is a fairly natural process, (28b) clearly does not state obstruent devoicing as a process of voice assimilation. (28a) is problematic: since a single occurrence of # does not bring about the process of devoicing, by analogy to (28b) and (28c) one would have to hold the second occurrence of # in (28a) responsible for the phenomenon of obstruent devoicing. Now, on the Chomsky and Halle (1968:66—67) analysis of boundaries,

boundaries differ from segments in that the former are specified [—segment] while the latter are specified [+segment]. Furthermore, since boundaries are supposed to differ from one another in terms of feature compositions (specifically, [FB] and [WB]), it would perhaps not be totally unreasonable to say that all of the [—segment] entities are automatically specified minus (—) for all the other distinctive features, and that distinctive features may be specified + or — only in entities which are specified + for the feature [segment]. Given this assumption, the # boundary in (28a) could be analysed as being, among other things, [—voice], and the process that (28a) describes might be viewed as a process of voice assimilation.

This view of the nature of boundaries was not uncommon in the first half of the 1970s. For instance, while speaking about the devoicing of obstruents in English, Rubach (1975a:127) states: "If a voiced obstruent appears after a pause or a voiceless segment then it is devoiced in the part adjacent to the voiceless context." Rubach obviously feels that a pause boundary should be treated as a type of voiceless context on a par with voiceless segments. On p. 128 he proposes "to regard pauses as functionally voiceless obstruents", which idea is traced back to Lass (1971), who is reported to maintain that "for German word boundaries should be treated functionally as voiceless obstruents."

This view of boundaries has been questioned by Aronoff (1976:121—122, *passim*), who holds that as structural entities, boundaries have no phonological substance in themselves and that "The phonological reflection of a boundary is a constraint on the operation of phonological rules." He dismisses the suggestion according to which at least some boundaries are analysed into phonological features, and argues that this suggestion is "as sensible as claiming that NP brackets are [—continuant]" (p. 122).

In the foregoing paragraphs I have described certain processes as natural without even providing a hint as to the nature of naturalness. One important clue can be found in the definition of the natural class as presented by Halle (1964:328; i.e., "a set of speech sounds forms a *natural class* if fewer features are required to designate the class than to designate any individual sound in the class"). Since phonological processes crucially involve natural classes, it is in this sense that they can be viewed as natural. It may happen, however, that a phonological process affects a natural class of segments in environments which also appear to form natural classes, but the process as a whole does not give the impression of being natural. This was the case with the processes of palatalization referred to above in connection with McCawley (1967); i.e., for a process of palatalization to be natural it is not enough that the class of segments undergoing the process and the class of segments conditioning it are storable as natural classes. One might impose an additional requirement such that there should be at least one feature [F] shared by the two (or more)

classes, but whenever one of the classes is specified α for the feature, the other is specified $-\alpha$ for the same feature. The process then affects the value of the feature so that the classes no longer differ in terms of the values for this very feature.

Returning now to the problem of the naturalness of rule (19), it can be observed that if the notion of natural process presented above is taken into account, the rule is natural in the interpretation when the condition it contains is disregarded. Does it mean that the presence of the condition makes the rule less natural? This does not seem to be true. The condition says no more than the following: "Leave intact the value for the feature [voice] whenever both the class of segments which is supposed to undergo devoicing and the conditioning class display identity in terms of the features mentioned in part *a* of the condition." It follows that, regardless of whether or not the condition is included, rule (19) is a fairly natural formulation.

With regard to the duplication of phonological material as it occurs in rules (19) and (20), it was stated that this duplication contributed an important ordering gain. Turning to rules (23) and (24), it turns out that although rule (24) duplicates nothing in rule (23), rule (23), especially the specification enclosed in braces, makes use of classes of segments which overlap. For instance, the specifications [+son] and [—cor] include, among other things, the segment /m/. Overlapping specifications crucially underlie the phenomenon of overkill, discussed in Rubach (1976b). The status of duplication is unclear. Whereas overkill, which crucially depends on duplication, is believed to be "an unavoidable consequence of the nature of phonostylistic rules" (Rubach 1976b:45—46), other cases of duplication are generally considered to result in undesirable complication of the grammar. Therefore, in what follows duplication will not be referred to as an argument.

In view of the discussion above, it follows that, given rules (19), (20), (23) and (24), there is not much ground for choosing between the alternatives stated as (25) and (26) above. Also, it appears that the line of argumentation developed in connection with the possible underlying representations /iz/ — /z/ carries over to the representations /id/ — /d/, since all of the rules mentioned above have been so designed as to take care of the ending regardless of whether the obstruent it contains is [+continuant] or [—continuant].

I now wish to discuss one other problem raised by Gonet (1979:72—75), namely, the relevance of the *-(e)d*-derived adjectives to the problem of the underlying representation of the endings which mark the preterite and past participle of regular verbs.

Following earlier studies by other authors, Gonet seems to favour the solution which suggests that the adjective-deriving suffix should be /id/ in contradistinction to the preterite- and past participle-deriving suffix which is /d/. It is further argued that, if the latter were stated as /id/, the class of derived

adjectives would have to be marked as not undergoing the rule of *i*-deletion. On the other hand, no exception features need be introduced when no such assumption is made.

Two misguided assumptions underlie the solution presented by Gonet. First, the class of adjectives is believed to form a completely homogeneous class which is opposed to the class of verbs (i.e., their preterite and past participle forms) by virtue of the form of the underlying representation of the suffix. Second, the alternation /*id*/~/*d*/~/*t*/ in the class of adjectives is assumed to be phonologically governed. I do not know the reason for this confusion.

Before continuing, I wish to make one observation in passing, namely, that whereas the specification of the preterite and past participle endings is part of English inflectional morphology which is taken care of by the syntactic component (prior to the phonological rules), the specification of the suffix in derived adjectives takes place in the lexicon and is part of the derivational morphology.

That the first of the above-mentioned assumptions underlies Gonet's line of reasoning is corroborated by the data he analyses and by generalization 1 (p. 73):

(29) LIST 1	LIST 2a	LIST 2b
léar[nid]	ashá[mid]ly	ashá[mid]ness
á[dgid]	prepá[rid]ly	prepá[rid]ness
cróo[kid]	léar[nid]ly	léar[nid]ness
crá[gid]	már[kid]ly	már[kid]ness
já[gid]	admí[tid]ly	admí[tid]ness
wré[tid]	amá[zid]ly	amá[zid]ness
LIST 3a	LIST 3b	
astóni[ft]ly	astóni[ft]ness	
dimíni[ft]ly	dimíni[ft]ness	
detérmi[nd]ly	detérmi[nd]ness	
exácerbà[tid]ly	exácerbà[tid]ness	
spécif[ayd]ly	spécif[ayd]ness	
preóocup[ayd]ly	preóocup[ayd]ness	

The generalizations which are supposed to reflect the distribution of the /*id*/ form of the suffix are as follows:

- (30) a. /*i*/ appears if the stem-final syllable is stressed, regardless of the nature of the stem-final syllable (i.e., whenever the stress-conditioned environment is met), and
 b. /*i*/ appears if it meets the phonological (i.e. *d*/*t*-*d*) context, regardless of stress.

Note that although Gonet intended to capture certain generalizations with regard to the class of derived adjectives, the data presented in (29) in fact includes three categories of items: derived adjectives (List 1), derived adverbs (Lists 2a and 3a) and derived nouns (Lists 2b and 3b). The feature shared by the data in Lists 2a, b—3a, b is that in all of them a derived adjective serves as the base of adverbial or nominal derivation. The question which suggests itself is whether it is correct to disregard the (as yet unexplained) effect of the suffixes *-ly* and *-ness* on the phonological shape of the base. If it were true that the suffixes had no effect on the base, we should expect all of the derived adjectives to have the same phonological shape regardless of the morphological environment in which they occurred. For instance, the derived adjectives *ashamed* and *amazed* should have the syllabic form of the suffix when used in isolation, but this is not the case.

A preliminary study of the *-(e)d*-derived adjectives shows that their surface forms display a greater amount of variation than one might expect. Generally, the following classes can be distinguished among the adjectives:

- (31) A class of adjectives ending in the syllabic form of the suffix, which contrast with the corresponding adjectives containing the non-syllabic form,⁶ e.g.:

a learn[id] word = 'a word which is learn[id]'

a learn[t/d] word = 'a word which has been learned (by someone)'

This class includes all the adjectives presented in List 1 of (29).

- (32) A class of adjectives ending in the syllabic form of the suffix, which can be used interchangeably with the corresponding adjectives containing the non-syllabic form (i.e., the syllabic and non-syllabic forms are in free variation), e.g.:

arm $\left\{ \begin{array}{l} [id] \\ [d] \end{array} \right\}$, *hoof* $\left\{ \begin{array}{l} [id] \\ [t] \end{array} \right\}$, *hook* $\left\{ \begin{array}{l} [id] \\ [t] \end{array} \right\}$

- (33) A class of adjectives possessing roughly the properties of (32), except that one of the variants is stylistically marked, e.g.:

- a. The non-syllabic variant is archaic (with a change in spelling)⁷

bless $\left\{ \begin{array}{l} [id] \\ [t] \end{array} \right\}$

- b. The syllabic variant is poetic:

prepar $\left\{ \begin{array}{l} [id] \\ [d] \end{array} \right\}$

⁶ The data for the classification in (31)–(35) have been taken from *The compact edition of The Oxford English dictionary* (henceforth CEOED).

⁷ Strictly speaking, the label *archaic* is a different kind of marking index than that of *poetic* in (33b) in that items which are marked as archaic cannot easily be accounted for in a synchronic description. This means that for the purposes of morphological derivation the base *bless* belongs among the items listed in (31).

(34) A class of adjectives which always take the syllabic form of the suffix by virtue of the fact that their base ends in a coronal stop (/t/ or /d/), e.g.:

land[id] (*aristocracy*)

admit[id] (*departure from the norm*)

(35) A class of adjectives which always take the non-syllabic form of the suffix, e.g.:

amaz[d], *asham[d]*, *astonish[t]*, *mark[t]*

In view of the above data, it follows that it is only in (34) and (35) that the form of the suffix (i.e., syllabic vs. non-syllabic) is governed phonologically: the syllabic form occurs whenever the final segment of the word attached to is /t/ or /d/, the non-syllabic form elsewhere.

Turning now to the derivatives in *-ly* and *-ness* formed from the *-(e)d*-derived adjectival bases, it appears that if the base of derivation is constituted by some of the adjectives mentioned in (35), the vowel /i/ intervenes between the base and the adjective-deriving suffix, e.g.:

(36) a. *amaz[d]*, but *amaz[id]ly*, *amaz[id]ness*
mark[t], but *mark[id]ly*, *mark[id]ness*

Since the adjectives listed in (32) and (33) follow the same pattern, it can be conveniently assumed that their derivatives in *-ly* and/or *-ness* are, in an overwhelming majority of cases, formed from the /id/ variant of the adjective.⁸

Contrast the behaviour of the above adjectives with that of such derived adjectives as *astonished*, which do not have any intervening vowel in their derivatives in *-ly* and *-ness*. The difference between the *astonished* type of adjectives and those exemplified in (36) is accurately accounted for by the generalization in (30a) (=Gonet's (1979:73) generalization 1.). At the same

⁸ This assumption can be dispensed with. Consider a preliminary formulation of the word formation rules which derive adverbs from adjectives by attaching the suffix #*ly*, and abstract nouns from adjectives by attaching the suffix #*ness*:

(i) $[X]_A \rightarrow [[X]_A \# ly]_{Adv}$

(ii) $[X]_A \rightarrow [[X]_A \# ness]_N$

Examples of adjectives which undergo rule (i) include the following: *active*, *bad*, *happy*, *lucky*, *nice*, and numerous *-(e)d*-derived adjectives. Since it appears that no phonological conditions need be imposed on the class of adjectives in question, rule (i) will apply to adjectives containing both the syllabic and non-syllabic forms of the suffix. If a derived adjective containing the non-syllabic form of the suffix happens to undergo rule (i) or (ii), the derived adverb or noun in turn will undergo rule (43) (see below) whenever it meets its structural description. Since only the *astonished* class of adjectives does not meet the structural description of rule (43), it follows that all adverbs and nouns formed from the remaining *-(e)d*-derived adjectives will follow the pattern exemplified in (36).

time, however, it should be realized that the generalization in question is incorrect when applied to independently occurring adjectives, but is correct when used to explain the behaviour of derived adjectives which go to compose derivatives in *-ly* and/or *-ness*.

Consider now the problem of how to formulate the derivational rules needed to generate the class of derived adjectives. I would like to suggest that the items which serve as bases in the process of derivation be divided into two classes: *marked* and *unmarked*. The class of marked bases would comprise all the examples listed in List 1 of (29) and possibly many more. Certain items would have to be specified, however, as *optionally marked*, these encompassing the examples mentioned in (32) and (33b). All the remaining items would be unmarked.⁹

Let us assume that the form of the adjective-deriving suffix is #d (i.e., the suffix is basically non-syllabic voiced). Also, it belongs to what Siegel (1974) refers to as *Class II Suffixes*: suffixes introduced with word boundary (#). The relevant derivational rule can now be written as (37):

(37) $[X]_Y \rightarrow / [X]_Y \# d]_{Adj}$

where $[X]_Y$ represents the class of all the lexical categories which undergo the process.

The alternation d/id is accounted for by the following rule of allomorphy (my notion of 'rule of allomorphy' is based on Aronoff's 1976):

(38) $\#d \rightarrow \#id / [X]_{Y_m} \text{ ---}$

where *m* is a marking index.

It would perhaps be interesting to see how rule (38) applied to those items which are specified as optionally marked, e.g., the verb *prepare*. In optionally marked lexical categories, the marking index can simply be enclosed in parentheses, e.g.:

(39) $[prepare]_{V(m)}$

(39) abbreviates the options presented in (40):

(40) a. $[prepare]_{V_m}$

b. $[prepare]_V$

⁹ It is perhaps interesting to observe that in the history of English, not all of the *-(e)d*-derived adjectives allowed comparison by adding *-er* and *-est*. Among those which did CEOED mentions the following: *aged*, *crooked*, *learned*, *wretched* (this is by no means an exhaustive list). For present-day English, Jones *Everyman's English pronouncing dictionary* mentions only *crooked* as still following the pattern. All of these adjectives have been derived from what I call obligatorily marked bases.

The application of rule (37) produces (41a, b):

- (41) a. [[prepare]_{v_m} #d]_{Adj}
 b. [[prepare]_v #d]_{Adj}

Rule (38) applies to (41a) alone, giving the desired result:

- (42) [[prepare]_{v_m} #id]_{Adj}

Items of the *land* type are unmarked and consequently do not undergo rule (38). In *landed*_{Adj} and other similar cases, the vowel can be inserted by rule (20) (revised as (22)), provided that the grammar possesses such a rule and, also, provided that the adjective-deriving suffix is introduced with word boundary, as postulated above.

One final problem remains to be discussed, namely, the appearance of a vowel in the derivatives formed from the adjectives in (35) by adding *-ly* and/or *-ness*. The following rule can account for this vowel:

$$(43) \sigma \rightarrow \left[\begin{array}{l} +\text{syll} \\ +\text{high} \\ -\text{back} \\ -\text{tense} \end{array} \right] / [\alpha\text{stress}] C_0 \# \# - d \# \left\{ \begin{array}{l} \#ly \\ \\ \#ness \end{array} \right\} \#]^{10}$$

where $\alpha \leq 3$

It is clear that derivatives in *-ly* and *-ness* derived from the *astonished* type of adjectives will not undergo the rule.

A few words of explanation are in order with respect to (43). Analysing *-(e)d* as a Class II suffix, and assuming Siegel's (1974) proposals concerning the structure of the lexicon (especially the claim that Class II affixation follows stress assignment rules), it becomes clear why (43) can make reference to stress placement without invoking global constraints of any kind. Since (37) derives adjectives from both (Class I-)derived and undervived lexical items, the latter are available for stress assignment prior to Class II suffixation. Thus, when #d is being attached to a specified base, the base has already been assigned stress. Therefore, when the newly formed adjective is used as a base for #ly or #ness derivation, its original stress will be preserved.

It might appear at first that the status of (43) is not altogether clear. The rule is motivated both phonologically (its reliance on stress placement)

¹⁰ It is important that in rule (43) α is not greater than 3. This follows from the necessity to account for the examples adduced in note 10 of Gonet (1979: 73). Thus, if, depending on dialect variation, the last syllable of the verbal base in the adjective *preoccupied* receives tertiary stress, the derived adverb, *preoccupiedly*, is subject to rule (43). On the other hand, if stress is quaternary (or still weaker), the adverbial derivative does not undergo rule (43).

and morphologically (the requirement that either #ly or #ness follows). Since, however, in the theory of morphology adopted for the purposes of this paper, rules assigning stress within lexical (as opposed to phrasal) categories have been shifted from the phonological component to the lexicon, rule (43) is believed not to be *phonologically motivated* in the strict sense of the term. It follows that (43) is a rule of allomorphy in Aronoff's (1976) sense. Recall that Aronoff understands a rule of allomorphy to be a rule which "applies to a morpheme, or other than phonologically designated set of morphemes, in the immediate environment of a designated morpheme or set of morphemes" (p. 113).

The discussion above enables one to reach the following conclusions. First, the class of *-(e)d*-derived adjectives presents problems of its own which are not directly comparable to those exhibited by the past tense and past participle endings appearing on regular (weak) verbs. Second, the underlying representation of the adjective-deriving suffix appears to be /d/, i.e., non-syllabic voiced. Third, the /d/ ~ /id/ alternation in adjectives (and in their *-ly*, *-ness* derivatives) is morphologically governed except for those cases where the bases end in /d/ or /t/ (e.g., *land*, *admit*). In the latter, this alternation is phonologically governed. Fourth, differences in the behaviour of the adjective-deriving suffix and the past tense ending can be accounted for by the fact that the former participates in derivational processes, while the latter participates in inflectional processes. On the whole, derivational processes tend to be less regular than inflectional processes.

Despite the fact that the two types of the *d*-suffix behave differently, they may present a common set of phonological problems. Suppose that of the two plausible underlying representations of the past tense and past participle endings, syllabic voiced is selected. The question which must now be answered is how rule (23) can differentiate between a string like #seem# #id# (Verb) and one like #learn# #id# (Adjective), or between #learn# #id# (Adjective) and #learn# #id# (Verb). The answer which readily suggests itself is that the rule should make reference to the category membership of the relevant string, thus having to contain the]_v bracket in its structural description. Recall, however, that (23) has been designed to apply to strings containing #z as an exponent both of the 3rd pers. sg. and of the nominal plural. Consequently, the label would have to be extended to encompass nouns.

An alternative analysis would be to select the non-syllabic voiced form as the underlying representation of the past tense and past participle endings. Rule (20) would then have additional motivation in that it would now apply not only to strings like [#kis# #z#]_N and [#wæd# #d#]_v, but also to strings like [#lənd# #d#]_{Adj}.

To conclude, of the two alternative proposals concerning the phonological shape of the adjective-deriving suffix and the past tense/past participle ending,

the non-syllabic voiced representation appears to be the more plausible. Its plausibility stems from the fact that in order to account for the relevant allomorphic variants, the phonological rules (i.e., rule (20) or a modification thereof) require less non-phonological information for their operation than in the other analysis. In particular, they do not have to take into account the category membership of the strings to which they apply.¹¹

In summary, the present paper has attempted to show how a theory of rule ordering in phonology can be used to determine the most plausible underlying representations of certain morphemes. Also, an attempt has been made to clarify the relationship between selected derivational and inflectional processes. The present discussion has presented sufficient argumentation to support the claim that the derivational morphology of English poses problems which are not altogether parallel to those presented by English inflectional morphology. The specificity of derivational morphology is reflected, among other things, by the fact that in many cases the output of the derivational rules, before entering the phonological component, must be processed by what Aronoff (1976) calls rules of morphological adjustment. In contrast to the readjustment rules of Chomsky and Halle (1968), which intervene between the syntactic and phonological components, rules of morphological adjustment are part of the lexicon.

¹¹ Some linguists are still inclined to set up insurmountable barriers between the present state of a language and its history. Since the given state of a language is always a function of, among other things, its historical development, it follows that the results of a historical investigation can contribute to determining the description of the present state. In their interesting paper, Keyser and O'Neil (1980) argue on historical grounds that circa 1250 the fragment of Middle English grammar which related to plural and genitive formation in nouns comprised two related patterns: (a) the native, which made use of the syllabic voiced ending and a rule of vowel elision (followed optionally by apocope), and (b) the Anglo-Norman, which made use of the non-syllabic voiced ending and a rule of epenthesis. In the course of development, this fragment was simplified in the following way: The plural and genitive ending assumed the shape of /z/ (i.e., non-syllabic voiced), with the rule of vowel elision being dropped and the rule of epenthesis extended (to insert a vowel whenever the preceding word ended in a consonant). Now the extended part of the epenthesis rule was optional and did the work of the earlier (optional) apocope rule. Subsequent changes eliminated the optional part of the rule (i.e., the rule began to function in such a way as to insert a vowel only when the word ended in an obstruent which exhibited similarity with the desinential obstruent. For details see Keyser and O'Neil 1980, especially rules (11a) and (1a)). Keyser and O'Neil argue that the rule of Modern English plural and genitive formation had assumed its shape by the end of the 17th century. (Also, see their remarks concerning past tense and past participle formation.) If Keyser and O'Neil are right, and if it is true that the synchronic rules of a language should not run counter to its history, of the two proposed underlying representations, syllabic voiced and non-syllabic voiced, the latter appears to be the more plausible.

REFERENCES

- Anderson, S. R. 1974. *The organization of phonology*. New York: Academic Press.
- Anderson, S. R. 1979. "On the subsequent development of the 'standard theory' in phonology". In Dinnsen, D. A. (ed.). 1979. 2—30.
- Aronoff, M. 1976. *Word formation in generative grammar*. Cambridge, Mass.: MIT Press.
- Barnhart, C. L., Steinmetz, S. and R. K. Barnhart. 1973. *The Barnhart dictionary of New English 1963—1972*. London: Longman and New York: Barnhart.
- Bauer, L. 1979. "Against word-based morphology". *Linguistic Inquiry* 10. 508—509.
- Bierwisch, M. 1967. "Syntactic features in morphology: general problems of so-called pronominal inflection in German". In *To honor Roman Jakobson*, vol. 1, 239—270. The Hague: Mouton.
- Chomsky, N. 1965. *Aspects of the theory of syntax*. Cambridge, Mass.: MIT Press. Eleventh printing 1976.
- Chomsky, N. 1977. "On *wh*-movement". In Culicover, P. W., Wasow, T. and A. Akmajian. (eds). 1977. 71—132.
- Chomsky, N. and M. Halle. 1968. *The sound pattern of English*. New York: Harper and Row.
- The compact edition of The Oxford English dictionary*. Vols 1—2. Oxford: Oxford University Press, 1971. Reprinted 1979.
- Culicover, P. W., Wasow, T. and A. Akmajian. (eds). 1977. *Formal syntax*. New York: Academic Press.
- Dinnsen, D. A. (ed.). 1979. *Current approaches to phonological theory*. Bloomington: Indiana University Press.
- Dinnsen, D. A. and F. R. Eckman. 1978. "Some substantive universals in atomic phonology". *Lingua* 45. 1—14.
- Fodor, J. A. and J. J. Katz. (eds). 1964. *The structure of language: readings in the philosophy of language*. Englewood Cliffs, New Jersey: Prentice-Hall.
- Gonet, W. 1979. "Phonological problems in the interpretation of the English inflectional endings". *Kwartalnik Neofilologiczny* 26. 63—79.
- Gussmann, E. 1972. "Fonologia generatywna". *Kwartalnik Neofilologiczny* 19. 427—437.
- Gussmann, E. 1974. "Nasality in Polish and English". *PSiCL* 2. 105—122.
- Gussmann, E. 1975. "How do phonological rules compare?" *PSiCL* 3. 113—123.
- Gussmann, E. 1977. "Variation and argumentation in phonology". *PSiCL* 6. 43—62.
- Gussmann, E. 1978. *Contrastive Polish-English consonantal phonology*. Warszawa: PWN.
- Gussmann, E. 1980a. *Introduction to phonological analysis*. Warszawa: PWN.
- Gussmann, E. 1980b. "The phonological structure of the Polish imperative". *Studia gramatyczne* 3. 33—46.
- Halle, M. 1964. "On the bases of phonology". In Fodor, J. A. and J. J. Katz. (eds.) 1964. 324—333.
- Halle, M. 1973. "Prolegomena to a theory of word formation". *Linguistic Inquiry* 4. 3—16.
- Hooper, J. B. 1975. "The archi-segment in natural generative phonology". *Language* 51. 536—560.
- Jackendoff, R. S. 1975. "Morphological and semantic regularities in the lexicon". *Language* 51. 639—671.
- Jakobson, R., Fant, C.G.M. and M. Halle. 1951. *Preliminaries to speech analysis: the distinctive features and their correlates*. (MIT Acoustics Laboratory Technical Report, 13.) Cambridge, Mass.: MIT Press.
- Jones, D. 1960. *An outline of English phonetics*. 9th ed. Cambridge: Heffer.
- Jones, D. 1963. *Everyman's English pronouncing dictionary*. 12th ed. London: Dent.

- Keyser, S. J. and W. O'Neil. 1980. "The evolution of the English plural rule". *Journal of Linguistic Research* 1/2. 17—35.
- Kiparsky, P. 1979. "Metrical structure assignment is cyclic". *Linguistic Inquiry* 10. 421—441.
- Ladefoged, P. 1971. *Preliminaries to linguistic phonetics*. Chicago: University of Chicago Press.
- Laskowski, R. 1977. "Morfologia w gramatyce transformacyjno-generatywnej: w poszukiwaniu modelu opisu". *Studia gramatyczne* 1. 103—133.
- Lass, R. 1971. "Boundaries as obstruents: Old English voicing assimilation and universal strength hierarchy". *Journal of Linguistics* 7. 15—31.
- Lieberman, M. and A. Prince. 1977. "On stress and linguistic rhythm". *Linguistic Inquiry* 8. 249—336.
- Makkai, V. B. (ed.). 1972. *Phonological theory: evolution and current practice*. New York: Holt, Rinehart and Winston.
- McCawley, J. D. 1967. "Le rôle d'un système de traits phonologiques dans une théorie du langage". *Langages* 8. 112—123. Reprinted in Makkai, V. B. (ed.). 1972. 522—528 as "The role of a phonological feature system in a theory of language". Also in McCawley, J. D. 1979. 20—29.
- McCawley, J. D. 1979. *Adverbs, vowels, and other objects of wonder*. Chicago: University of Chicago Press.
- Rubach, J. 1975a. "Low phonetic voice assimilation with obstruents in Polish and English". *PSiCL* 3. 125—139.
- Rubach, J. 1975b. "On contextual modifications of plosives". *PSiCL* 3. 141—157.
- Rubach, J. 1976a. "Deep versus detail rules in phonology". *PSiCL* 5. 27—37.
- Rubach, J. 1976b. "Overkill in phonology". *PSiCL* 5. 39—46.
- Rubach, J. 1977. *Changes of consonants in English and Polish*. Wrocław-Warszawa-Kraków-Gdańsk: Zakład Narodowy im. Ossolińskich.
- Schane, S. A. 1973. *Generative phonology*. Englewood Cliffs, New Jersey: Prentice-Hall.
- Selkirk, E. O. 1972. *The phrase phonology of English and French*. MIT dissertation.
- Siegel, D. C. 1974. *Topics in English morphology*. MIT dissertation.