Remarks on the phonology of English inflection

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A description of the phonology of a language usually starts from a consideration of alternations in the shape of fully productive inflectional elements, and proceeds from there to consider less productive inflections, derivational elements, and regularities that obtain in the shapes of individual morphemes. It is noteworthy, therefore, that a treatment of English phonology as comprehensive as that of Chomsky and Halle (1968) contains virtually no mention of the productive inflectional elements of the language, and makes little attempt to establish rules that will cover the behavior of these morphemes. Noteworthy, but not particularly surprising: it is undoubtedly true that the major problems in describing the overall pattern of English phonology are, as Chomsky and Halle assume, the assignment of stress and the alterations between ‘tense’ and ‘lax’ vowels (e.g., retain/receptive; convolve/convolution; describe/description etc.). It is precisely in these areas that the productive inflectional morphemes are completely unenlightening: their presence or absence does not affect the placement of stress, and vowels preserve the same values of ‘tenseness’ before them as in corresponding words without them. Despite the somewhat peripheral nature of these morphemes, however, their phonology is not without a certain amount of intrinsic interest. A moderate literature has grown up in this area, especially in recent years, whose inconclusiveness attests to the difficulties lying behind these apparently trivial problems.

A complete list of productive inflectional elements in English would include 1) the ‘ordinary s-ending’ (so-called by Jespersen); 2) the dental stop ending found in the preterite and participial forms of regular verbs; 3) the comparative and superlative endings of adjectives; arguably 4) the ending -en found in some participles and causatives, as well as elsewhere; and 5) the ending -ing of present participles and nominalizations. Our
concern here will be limited (as is most of the literature) to 1 and 2, where
the most interesting problems arise. As is well known, these each occur
in three basic shapes in the speech of most English speakers: 1) a syllabic
form, which we can write as /dz/ and /d³/, which appears after ‘similar’
consonants (thus, /dz/ appears after dental sibilants s, z, ñ, ñ, à, j, while
/d/ appears after dental stops t and d); 2) a voiceless form (-s or -t) which
appears after voiceless consonants other than those followed by the
syllabic form; and 3) a voiced form, which occurs after voiced sounds other
than those taking the syllabic form (thus -z and -d follow vowels, glides,
sonorants, and voiced obstruents).

There is general agreement on the proposition that each of these
elements can appropriately be represented by a single basic shape, while
the other variants are produced by rules operating solely in terms of
sound structure. Thus, the situation is not the same as that of the plural
morpheme in general, some of whose alternants are conditioned by partic-
ular lexical items and not by any elements of sound structure (e.g., as
-en after ox, as ‘Umlaut’ in mouse, goose, etc., and other well-known
irregularities). There is not so much agreement on the shape of these
basic forms, however. It is clear that any of the three shapes could be
chosen as basic, and a set of rules constructed to derive the others from
it³. Thus, if the syllabic shapes (/dz/ /d³/) are taken as basic the rules in
(1) below would be required⁴:

(1) a. $\dot{\iota} \rightarrow \emptyset$ / $\begin{bmatrix}
-\alpha \text{strid} \\
-\beta \text{cor} \\
-\gamma \text{cont} \\
+ \text{nas}
\end{bmatrix}$ $\# \begin{bmatrix}
+ \alpha \text{strid} \\
+ \beta \text{cor} \\
+ \gamma \text{cont} \\
- \text{nas}
\end{bmatrix}$ $\#$

b. [+cons] $\rightarrow [\text{voice}] / [\text{voice}]$ $\#$ $\#$

If the voiced non-syllabic shapes (/dz/ and /d/) were taken as basic, on
the other hand, the rules in (2) would be required:

(2) a. $\emptyset \rightarrow \dot{\iota}$ / $\begin{bmatrix}
+ \alpha \text{strid} \\
+ \beta \text{cont} \\
- \text{nas}
\end{bmatrix}$ $\#$ $\begin{bmatrix}
+ \alpha \text{strid} \\
+ \beta \text{cont} \\
\end{bmatrix}$ $\#$

b. (same as (1 b))

In the third possible analysis, with underlying /s/ and /t/, we would
need the rules in (3):

(3) a. $\emptyset \rightarrow \dot{\iota}$ / $\begin{bmatrix}
+ \alpha \text{strid} \\
+ \beta \text{cor} \\
- \gamma \text{cont}
\end{bmatrix}$ $\#$ $\begin{bmatrix}
+ \alpha \text{strid} \\
+ \beta \text{cor} \\
\end{bmatrix}$ $\#$

b. [+cons] $\rightarrow [\text{voice}] / [\text{voice}]$ $\#$ $\#$

Each of these is a possibility, and indeed combinations can also be
imagined (thus, Sloat and Hoard (1971) assume /z/ and /t/, and thus
require a combination of (2) and (3)). The arguments for and against
each possibility that have been presented have not, however, been particu-
larly overwhelming.

The first modern linguist to take a position on this question was
probably Bloomfield (1933). He noted that, in addition to the formation
of plurals, genitives, 3rd person singular verb forms, and so on the alter-
nation /dz/-/d/-/s/ also occurs for the contracted forms of the auxiliaries
has and is. Thus, parallel to horses/dogs/cats we have Alice’s/Mary’s/Pat’s
gone to the store for bread). These auxiliary verbs certainly have vowels
in their basic forms, and a rule will be necessary to delete these vowels
in the contracted forms; Bloomfield suggests that if we take /dz/ (and, by
extension, /d/) as basic, this rule can be generalized to account for the
inflections as well. He thus opts for the solution with rules (1), on the
grounds that these rules are necessary in the grammar of English in any
event.

Bloomfield is followed in this analysis by several others. It is possible
that Jespersen intended this, since he places contracted auxiliaries in his
list of uses for the ‘ordinary s-ending’; but he does not state the argument,
and indeed says that ‘such abbreviations fall outside our Morphology.’
Essentially the same argument as Bloomfield’s is given by Luelsdorff
(1969). A problem with this analysis is the fact that contraction is much
more complex than the distribution of the shapes of the s-endings and
the d-endings: it has been shown by King (1970) and Zwicky (1970) that
contraction is an optional rule, conditioned by a large number of com-
plicated syntactic phenomena (e.g., it is blocked if the element to be
contracted was followed at some point in the syntactic derivation of the
sentence by an element which has since been deleted: thus, we cannot say *John isn’t going, but Harry’s for John isn’t going, but Harry is (going)*. The rules for the inflectional morphemes, on the other hand, are obligatory and subject to no such conditions. Zwicky (1970) however, suggests that this is in fact no obstacle. He argues that the rule of auxiliary reduction simply has the effect of making the auxiliary element a clitic (and deleting the initial h of has); once the element has become a clitic, it undergoes the same rules as the inflectional elements. The optionality and complex syntactic conditioning, then, are all properties of the cliticization rule, and the rules in (1) do not have to be made more complex. He thus attempts to avoid Lightner’s (1970) conclusion that the similarities in shape between the contractions and the inflections are no more than a superficial resemblance.

Unfortunately, in disposing of this objection to the analysis in (1) (as supported by the facts of auxiliary contraction), Zwicky has also disposed of the argument. He has shown that cliticization is a distinct process from affixation (if we designate the rules specifying the forms of inflections by this name); but he has not thereby shown that cliticization leaves a syllabic residue. That is, he has not demonstrated that the vowel of is, has is preserved in the clitic forms that then undergo ‘affixation’. It could perfectly well be the case that the clitic forms are /z/, rather than /iz/. Indeed, when we look at the phonology of cliticization further, we see that there is some support for this view. Not only is and has can be contracted, but also had, as in Tom’d already seen it, and would, as in Bill’d like to have one too. Now on the analysis that says cliticization simply alters stress and boundary placement, and deletes initial consonants (thus converting / *** tam *** hæz *** . . . / and / / *** tam *** hæd *** . . . / into / *** tam * iz *** . . . / and / *** tam * id *** . . . /), we would expect contracted forms of had and would to show the same range of shapes as the regular preterite endings, just as contracted has shows the same range of shapes as the plural, etc. endings. This is not the case, however; the vowel of had is only lost (discounting rapid speech, where virtually any unstressed vowel may be lost) after another vowel. Thus, we have Mary’d (already seen it), with non-syllabic contracted had, but in all of Tom’d Alice’d/Pat’d, the vowel is preserved, regardless of the final consonant of the preceding word. A natural account of this would be to say that where the final consonant of an element which becomes a clitic is continuant, cliticization reduces the element to this consonant alone; but where the final consonant is a stop, cliticization reduces the element to a reduced vowel plus the stop. Then the rules in (2) will correctly specify the phonetic variants of is, has when they become clitics (and are reduced to /z/), but will not affect the clitic form of had (/id/). The only circumstance in which this word loses its vowel in contraction is due to a separate rule reducing sequences of vowels. This analysis provides some support for positing non-syllabic variants for the endings, with the rules of (2); and no support whatever for the analysis with syllabic endings, and the rules of (1). The argument from contraction thus does not point in the direction assumed by Bloomfield, Luelsdorff, Zwicky, and others.

Another argument related to this issue is given by Hockett (1958). This argument is based on the notion of ‘automatic alteration’, which Hockett characterizes as an alternation such that “if [it] did not take place, the phonemic pattern of the language would be different from what in fact it is.” The import of this in the case we are considering is the following: English phonotactic principles do not allow final clusters of obstruents that differ in voicing, and also do not allow clusters of sibilants or of dental stops (at least finally). Thus, if the plural and past endings were /iz/ and /d/, both of the rules in analysis (2) (or in (3), for that matter) would have the effect of altering forms which would otherwise violate these restrictions so as to ‘correct’ the violations: in one case by breaking up impossible clusters, and in the other case by assimilating them in voicing. No such argument can be given for rule (1 a), however: it serves to delete a vowel, but the forms on which it operates (e.g., / *** Bill * iz *** /) violate no restriction of the language, and so the rule cannot be said to correct such a violation. Hockett thus assumes that (at least a large class of) phonological rules have a direct motivation in the surface phonetic facts of the language: that they serve to make forms conform to what are otherwise true generalizations about surface forms. This is a very interesting position, and one which has been explored by Kiparsky (1971) under the name of ‘transparency’. There is certainly a good deal to be said for the notion, and the role of surface phonetic constraints in phonology (also explored by Shihataani (1972 b) deserves further exploration. It is unfortunately the case, however, that some phonological rules are more transparent than others (in Kiparsky’s terms):
that is, some rules have little or no motivation in terms of surface phonetic constraints. While Hockett's argument is suggestive, therefore, it is not conclusive, since we cannot require all phonological rules to be "automatic alternations", and thus we have no a priori reason to assume that the rules for English inflection have this character.

Another argument from surface patterns is given by Basboll (1972), who is concerned to show that /s/ and not /f/ is the correct basic form (Basboll does not consider the possibility of /ts/ in this paper). He argues that s is only found in the position where English does not admit a contrast between voiced and voiceless obstruents (namely, after another obstruent), while z is found in positions where such a contrast is possible (namely, after a sonorant). On these grounds, it is appropriate to take z as the 'elsewhere' case, representing the basic form of the ending, rather than s. While this use of surface phonetic facts, like Hockett's, is interesting and suggestive, it is hard to assess its bearing. We have no principled basis on which to say that a set of rules like (3) is not possible in a natural language, and these rules correctly specify the facts: the interaction of surface phonetic facts, underlying shapes, and the concept of 'elsewhere cases' does not seem clear enough to provide unambiguous motivation for an analysis here.

Before proceeding to a further discussion of this problem here, we should first clarify the structural position of the inflectional endings in question. We have assumed that these are separated from the preceding element in underlying forms by a word boundary (\#), rather than simply by a formative boundary (+). This is an important fact about these formatives, and lies at the heart of all of the formulations (1), (2), and (3). It is motivated by several considerations. First of these is the fact that the addition of an affix often changes the location of the stress: thus, we have moment with initial stress, but momentous with stress on the second syllable. Inflectional affixes, however, do not have this property: impertinence and its plural impertinences have stress on the same syllable, despite the addition of a syllable in the plural (giving rise to a rare sequence of three unstressed syllables). Stress is assigned to words as if the inflectional elements were not present, which is expressed by saying the word boundary falls before them.

A second process which differentiates two sorts of affixes is the loss of g in the sequence ng. After causing the preceding nasal to appear as velar (\#), the g is deleted in this sequence at the end of a word (as in long) and before some (stress-neutral) affixes, as in longing and longer (one who longs for something), but not before others (e.g., longer 'more long', length, etc.). This distinction is captured by having some affixes preceded by word boundary (e.g., -ing 'present participle' -er 'agent nominal') and others preceded by morpheme boundary (e.g., -er 'comparative'). /g/ is then deleted in the environment -\#n.

A third complex of phenomena related to boundary type has to do with the assimilation of voicing. Before most derivational formatives beginning with a voiceless obstruent, a final voiced obstruent is devoiced: thus, we have describe but descriptive, etc. Before the inflectional endings, however, the assimilation is not regressive but progressive. The root final in both described and eloped preserves its original character, and the inflection is assimilated to it. Since these cases in which the assimilation is regressive (as in descriptive) all involve affixes that otherwise behave as part of the phonological word with the preceding element, we assume they are preceded by + and that the affixes which assimilate progressively are preceded by word boundary. The voicing assimilation rule in all three solution (1), (2), and (3) above is thus restricted to operate only over a (single) word boundary.

Related to this voicing assimilation is a rule of laxing which affects vowels before clusters. When clusters arise over a morpheme boundary, these usually have the effect of converting a preceding 'tense' vowel into a 'lax' vowel, as in retain/retentive, describe/descriptive, etc. This laxing does not occur before clusters formed by adding an inflectional element, however: scraped ends phonetically in the cluster -pt, but this does not shorten the vowel to [skræpt] or [skræpt]. Here again, we presume the laxing rule applies across + but not across word boundary.

One more process which is relevant is the simplification of geminates. Chomsky and Halle (1968) argue that the distribution of English stress and some related phenomena become much more regular if some consonants are assumed to derive from geminates, even though such geminates do not occur within words in surface phonetic forms. The grammar thus requires a rule of simplification, by which CC is reduced to C if the two are identical, after the assignment of stress and other properties. The operation of this rule can be seen in derivation: adjectives in -ive are often formed with -tive instead, as in retentive. Roots ending in t or d
never show the sequence \textit{tive} or \textit{dive}. We must nevertheless assume that such sequences exist in underlying forms. In the pair \textit{attend/attentive}, the devoicing of the root final \textit{d} would be naturally accounted for by the presence of a following \textit{t}, causing the devoicing rule of \textit{describe/descriptive} to apply. The resulting form \textit{attentive} must then undergo geminate simplification if the single \textit{t} of \textit{attentive} is to result. This simplification process, however, takes place only over boundaries; over word boundaries, the geminate is separated into two elements by a vowel, as in \textit{raided}.

Further details of these and other relevant processes can be found in Chomsky and Halle's work. The point is that a number of distinct phenomena can be related to the difference between two sorts of boundary, and in all cases these criteria converge on a representation of the inflectional elements 's' and 'd' with preceding word boundary. Thus, 1) they are stress-neutral; 2) they provoke g-deletion (as in \textit{longed}, phonetically [lɔnd], not [lɔngd]); 3) voicing assimilation is progressive, rather than regressive; 4) vowels do not lax before clusters formed by adding them; and 5) geminates do not simplify, but are rather broken up by inserting a vowel (or, on analysis (1), by preventing it from being deleted). This consistency suggests the appropriateness of the boundary representation; in every case, the word behaves as if the inflectional elements were not there, which is a natural interpretation of the presence of a word boundary before them.

Having established the character of the boundary which separates inflectional endings from the word they are associated with, we can now turn to the endings themselves. The ending with the widest range of uses is the 'ordinary s-ending', which is used to form (1) plurals of 'regular' nouns; 2) genitive singulars of nouns; 3) genitive plurals of nouns; 4) the third person singular form of non-modal verbs; 5) a class of adverbs, such as \textit{nowadays}, \textit{meantimes}, \textit{thereabouts}, etc.; 6) the contracted forms of \textit{is} and \textit{has}. As we have shown above, this last category follows the same rules as other instances of the \textit{s-ending}, once it has become a clitic, regardless of whether the syllabic or the non-syllabic analysis is adopted. As described by Jespersen (1942), the ending was syllabic \textit{-es} in Middle English; the \textit{s} was voiced after a final unstressed syllable, and then \textit{e} was lost. The fact that the ending was originally syllabic, however, like the fact that contracted auxiliaries are underlyingly syllabic, does not show that the synchronic form of the \textit{s-ending} is syllabic; the loss of syllabicity may well have resulted in a restructuring, so that it is now underlying /\textit{z}/ (or perhaps /\textit{s}/).

Concerning the question of whether the ending is synchronically syllabic or not, there are two facts from dialects other than the standard that suggest a non-syllabic analysis. Shibatani (1972 a) notes that in the Black English dialect described by Labov (1969), clusters that end in a stop usually lose the stop before a word beginning with a consonant. Thus, first \textit{thing} and last \textit{month} generally become \textit{firs' thing} and \textit{las' month}, but first of \textit{all} and last \textit{October} preserve the final stops in the clusters. The shape of plural endings after these reduced clusters is \textit{+z}; thus, the plurals of \textit{test}, \textit{fish}, and \textit{desk} are phonetically [tesiz], [fišiz], and [desiz]. If the plural ending is underlyingly /\textit{z}/, this follows naturally; cluster simplification applies after the consonant initial ending, and then epenthesis (rule (2 a)) applies. It is hard to construct a plausible account of this phenomenon, however, on the basis of syllabic underlying representations such as /\textit{test} \# \textit{iz}/.

Another such argument from non-standard dialects can be constructed on the basis of some speakers who claim to make a difference in the final spirants of, e.g., \textit{races} and \textit{raises}. These speakers claim that the final sound in \textit{races} is an \textit{s}, while the final sound in \textit{raises} is a \textit{z}. For them, then, assimilation in voicing takes place after sibilants as well as after other obstruents. This is naturally explained if we take the non-syllabic analysis ((2) or (3)), and say that for these speakers voicing assimilation precedes epenthesis ((2 a) or (3 a)). In the standard dialect, of course, the rules apply in the opposite order. In underlying representation, the spirant of the plural ending will be immediately adjacent to the root, and hence capable of undergoing assimilation if this rule precedes epenthesis. If we took the syllabic analysis of the ending, however, the final spirants of \textit{races} and \textit{raises} would never be adjacent to the root final consonants, and so there is no obvious way the spirant of \textit{races} could be assimilated to the root-final.

Both of these arguments suggest that the non-syllabic analysis is to be preferred for the \textit{s-ending}. Since both are limited to non-standard dialects, however, their bearing on the analysis of the standard dialect(s) of English is uncertain. It could perfectly well be that these dialects have restructured the \textit{s-ending} (in addition to the other differences from stan-
dard English which they exhibit), and so cannot be used as evidence. Evidence from standard English could take two forms (at least): we might find reason to believe that a final sibilant is adjacent to the s-ending at some point in the derivation (which would suggest that the non-syllabic analysis is to be preferred); or we might find that there are other inflectional elements which require the syllabic (or the non-syllabic) analysis, and which do not behave in the same way as the s-ending. The failure of these other elements to undergo the rules posited for the s-ending on one or another analysis, then, would be evidence that the analysis of this ending was incorrect, and should be changed.

No clear examples of this sort of formative exist in English, to our knowledge. There are at least two other morphological elements in the language which must have the shape VS (where V is a vowel and S is a sibilant), and which do not behave in the same way as the s-ending; but neither of these is exactly like the s-ending in other properties. The ending -ess of princess, mistress, poetess, etc. is generally stress-neutral, and insofar as evidence is available, should be preceded by word-boundary. The vowel of this syllable is generally unstressed (in American English, at least) and hence reduced to ə. It would seem, therefore, that if (1) is the correct analysis of the plural (etc.) ending, the ending -ess ought also to undergo syncope, giving forms like princess, but mist(e)rs (for mistress), poets (for poetess), etc. This conclusion could be avoided in either of two ways, however; either the ending could be given as /iss/, which would undergo geminate simplification but which would not be eligible for syncope by (1a) because the post-vocalic spirant is not in final position (being followed by another s); or we could say that the vowel of the suffix is really /e/, not /ə/, and that (1a) only syncopates /s/. Vowel reduction would later convert this /e/ into [i], but by that time it would be too late for syncope to apply. This conclusion would be in accord with native speakers' intuitions that the last vowel of princess is in fact e; and most words containing this element have an optional alternate pronunciation with unreduced e.

Another affix which appears to satisfy the conditions for (1 a) is the ending -ous of furious, murderou, auspicious, etc. This ending also shows the reduced vowel i in phonetic forms, and here the possibilities discussed for -ess seem more far-fetched (the geminate analysis does not accord with speakers' feelings, though the form preciosity, if derived from pre-}

cious with is, might possibly be adduced as evidence for non-reduced vowel quality in the underlying shape of the affix). The most important argument against treating this ending as analogous to the plural, etc., however, is the fact that it is not stress-neutral: pairs like miracle/miracul·ous, mélodo/mélo·dis·ous, etc. show that this affix forms part of a phonological word with the preceding element, and so should be preceded by + rather than by word boundary. It would not, therefore, fit the environment of (1 a), and so its failure to syncope cannot be used as evidence against that analysis.

There are, therefore, no endings which differ in their behavior from the s-ending, and which must be treated as underlyingly syllabic, having the shape /VS/ and preceded by word boundary. There are also no endings which must be treated as underlying /S/ preceded by word boundary, and hence no evidence is available from this source that bears on the choice between the syllabic and the non-syllabic analysis of the s-ending. There is, however, one fact which suggests that the spirant of the s-ending is immediately adjacent to the final segment of the preceding element at some point in its derivation. This is the shape of the genitive plural.

Orthographically, a distinction is made between the boys (plural), the boy's (genitive singular), and the boys' (genitive plural). Phonetically, however, these are all alike. If plural and genitive each have the shape /z/ (or /s/, or /z/), we must explain why only one of these occurs in the phonetic shape of the genitive plural. Why, that is, do we not have boy's (as is sometimes attributed to some non-standard dialects)? This cannot be simply a peculiarity of the genitive plural, since the 's of the genitive appears in addition to the plural marker wherever the plural marker is other than the regular s-ending. Thus, we always have the oxen's yoke, the children's playground, the postmen's benevolent fund, the geese's beaks, etc., with both plural and genitive phonetically represented (in addition, of course, to the deer's cage, etc. where plural is phonetically null). It is only after plurals formed with the s-ending that the genitive is uniformly lost. This fact is not to be confused with the loss of the genitive after nouns ending in sibilants: though genitives such as Ross' thesis, Roger Williams' sound law, etc. are often written with only an apostrophe to represent the genitive, the syllable itself is usually preserved. In American English, it is always preserved after stressed vowels, and variably elsewhere. The genitive is always lost after the plural, how-
ever, even if this follows the stressed vowel; we always have the cats’ claws and not the cat’s claws. Whatever principle is involved for genitives of nouns ending in s, therefore, it is distinct from that which deletes one of the two s-endings in the genitive plural.

There is, in fact, already a rule in the grammar of English which will account for this fact, if the appropriate assumptions are made. This is the rule of geminate reduction, which we have already referred to above. Geminate reduction deletes one of two identical consonants when they are adjacent, and of course if both the plural and the genitive have the shape /ζ/, one of them could be deleted by this rule. Let us assume, with Chomsky and Halle (1968), that lexical items are bounded on both sides by word boundaries. In addition, we assume that phonological words are surrounded on both sides by word boundaries. We have already argued that the plural and the genitive are preceded by word boundaries, which we can interpret to mean that each is added after the boundary marking the end of the lexical item, but before the end of the entire phonological word. On the assumption that the s-ending is non-syllabic, then, both boys and boy’s will have the representation /# # boj # z #/. In the genitive plural, we assume two instances of /ζ/ will be present, and both will follow the lexical-item-final word boundary but precede the phonological-word-final word boundary. We have no reason to believe, however, that the two elements themselves are separated by anything other than formative boundary (+): both are assumed to be adjoined to the lexical item, but there is no obvious reason to assume further phonologically relevant structure. The underlying structure of boys’, then, will be /### boj # z+z #/. To this representation, geminate reduction will apply (obligatorily), giving /### boj # z #/. This account explains the fact that the genitive plural coincides phonetically with the genitive singular and with the ordinary plural exactly in case the noun forms its plural regularly (i.e., with the same s-ending that appears in the genitive). Notice, however, that this argument is only applicable if the s-ending is taken to be non-syllabic. If the ending is taken to be syllabic, there is no longer any reason for /### boj # iz+iz #/ to be reduced to /### boj # iz #/ (and thence to /### boj # z #/). This fact, then, provides useful evidence in favour of the non-syllabic underlying representation of the s-ending.

Turning from the s-ending to the dental stop ending found in the past forms of regular verbs, we must first of all distinguish some instances of a dental stop in verbs from others. We suggest that there are three sorts of process involved in the formation of the principal parts of verbs in English. First, there is a relatively large (but limited) class of verbs that show Ablaut, or vowel gradation in their principal parts. This is the type of sing/sang/sung, ride/rode/ridden, get/got/gotten, and several other patterns. We have nothing to say here about the principles behind this vowel alternation, and are concerned only with preterite (and participial) formations involving suffixes. Of the suffixal formations, there is one large (but, again, limited) class in which the past (and participial) form is built by suffixing -t. This is, in its most basic form, the class of burn/burnt, learn/learnt, etc. This pattern is unlike that of the ‘regular’ or fully productive formation, in that the final dental stop is voiceless. Another difference from the regular formation becomes apparent when we consider verbs with long vowels in the root. Verbs like mean/meant, deal/dealt, etc. show shortening of the stem vowel before the cluster of stem final consonant plus t, which we saw above was a sign that the cluster in question is divided only by a + boundary. This same shortening also appears in verbs with long vowel plus obstruent: sweep/swept, creep/crept, etc.

Another characteristic of clusters formed across + boundary, we saw above, was regressive voicing assimilation, which we also find in past forms like leave/left, lose/lost, etc. with both assimilation and shortening. As expected, some stems in short vowel plus t are invariable, such as bet/bet, shut/shut, cost/cost; these we analyze as taking the same +t suffix, with no phonetic difference from the singular remaining after the application of geminate reduction. In verbs with long vowels, however, the presence of the geminate is attested by shortening in verbs like bite/bit, meet/met, etc. The geminate likewise has an effect after a final voiced dental: in bend/bent, build/built and the like, the past is also formed by the addition of t, which provokes regressive voicing assimilation and then geminate reduction. In all of these forms, the dental suffix is simply t, which is never preceded by the reduced vowel and so is unambiguous as to its basic form. The one point of interest is that this t, unlike the t which arises by assimilation from the regular suffix (as in elope/eloped) is preceded by + rather than by word boundary, as shown by its ability to provoke laxing, regressive devoicing, and geminate reduction. This
then, is a modification of the basic word (just as an Ablaut past form is) rather than a sort of quasi-clitic added after it and leaving it unchanged.

In addition to  alone, there are a certain number of similar verbs that seem to call for  added to the stem. Forms such as  and  are ambiguous in this respect: in addition to their change of vowel, their dental suffix could be either the regular form (as in  or ) or a  preceded only by + boundary, since the cluster  does not in general provoke shortening; and there is thus no way to distinguish  from  (as in ). In  and others, however, vowel laxing does take place, attesting to the presence of a cluster in the past form (later lost by degemination). Verbs like  and  etc. would appear to be the counterpart of , , : invariant stems, with short vowels followed by diplaments. We might suggest that there is an element  which is added directly to stems, in addition to the  we have already suggested above. This same element  might then be found in verbs like  etc. The occurrence of shortening in these past forms is only apparently anomalous; as Chomsky and Halle (1968) have shown, English has a rule which tenses word-final vowels, which can apply in the present forms of these verbs. The stems are thus / / and / /, which undergo tensing (and subsequent vowel shift) in the present, but which are non-final in the past before  and so remain unchanged.

The distribution of this hypothetical  is somewhat defective. It only appears after vowels, and after voiced dentals immediately preceded by a vowel. On the other hand, there are no vowel final verbs which form past tenses in ; and all of the verbs with final  which add have the final  preceded by another consonant (as in ). We might, therefore, suggest that this complementarity should be accounted for by positing only one ending for these two cases, and deriving the other form by rule. From the distribution above, it is apparent that  should be chosen as the basic form, and the necessary rule is approximately (4):

\[ t \rightarrow d / / (d) + \# \]

The parentheses in this rule indicate that the  is optional. The phonetic motivation of the rule is not very transparent (though it is apparently a sort of voicing assimilation), and it is not clear that it should be treated as phonological rather than morphological. Some such rule is clearly indicated, however, and it allows us to reduce the number of past-formatives that are added directly to the root to /t/ alone.

Positing such an element /t/ which is added directly to the root explains all but a handful of the ‘irregular’ verbs that are not formed by Ablaut. For our purposes, however, the principal interest of this result is that it allows us to disregard verbs formed with this element when we consider the basic shape of the ‘regular’ past formative. As with the s-ending, there is a question as to whether this should be taken to be syllabic (/d/) or non-syllabic (/d/ or /t/). We might, of course, simply take the ending to be non-syllabic on the basis of the fact that the s-ending has already been shown to be non-syllabic, and so the rules in (2) (or possibly (3)) will be required in the grammar in any event. In that case, it is no more complex to make use of them to account for one more formative’s behavior; but it would be much better if some evidence were available to show that this formative, too, should be subsumed under the same principles.

We know of no direct evidence for the non-syllabic character of the regular dental past ending: that is, we know of no processes that must apply to representations without the ‘supporting’ vowel even in forms where this vowel appears. This was the sort of evidence we were able to adduce in connection with the s-ending: although the s-ending is normally syllabic after a coronal strident, it must be non-syllabic after another instance of the s-ending in order to explain its deletion by geminate reduction. Concerning the dental past ending, however, there is evidence of another kind. There is a distinct ending, whose representation should be /d/ in basic forms, but which cannot be allowed to undergo vowel loss by rule (1 a). If this rule were present in the grammar of English in order to explain the dental past ending, we would expect it to apply to this other ending as well. The rules in (2) or (3), however, would not make this incorrect prediction; and this constitutes evidence in favor of representing the dental past ending by a non-syllabic form.

The ending in question is one which is often confused with the dental past, though they must be kept distinct. It is the -ed of adjectives such as aged, learned, behovèd, weddèd, wretchèd, etc. In many cases, these forms are minimally paired with past forms of regular verbs. Thus, we have both John has aged since I last saw him, and John is now an aged roué; John has learned nothing at Harvard and John is a learned professor at Harvard; Mary and John have not been wed for long and John has thus far avoided wedded bliss, etc. For some of these forms, there is
no corresponding verb: thus *wretched, beloved, naked, sacred*, and others. The difference phonologically in all of these cases is that the adjective form preserves the vowel of the endings, while the verb form does not.

The situation is somewhat complicated by the fact that participial forms of verbs are also usually usable as modifiers: thus, we have not only *an aged crone* (with two syllables), but *a well-aged bourbon* (with one). The forms with the vocalic shape for the ending are usually semantically specialized, in a way that is characteristic of derivational formations. Thus, *a learned man* is not simply one who has learned something (or, still less, the literally expected ‘one who has been learned’), but rather one possessed of great erudition. The generalization is that where both forms exist, the form with vocalic ending and semantic specialization is usable only as an adjective, while the one with consonantal ending and a directly corresponding verb is the only one which can be used verbally.

A further environment in which primarily the forms with vocalic ending appear is in many derivatives, especially in the productive derivation of adverbs in *-ly* from adjectives. Thus, we have *preparedly, assuredly, admittedly, implicitly*, etc., as well as *fixedness, perplexity*, and others, in all of which the ending appears with a vowel, regardless of the preceding sound.

It might be claimed that these forms are in fact evidence for the syllabic character of the regular dental past ending. We might suggest, that is, that these environments are somehow marked as exceptional with respect to rule (1 a), and that accordingly both verbal and adjectival forms are built with the ending *-/d/*, with only adjectives preserving the vowel after consonants other than dental stops. This cannot be the case, however: there are some cases in which the *-ed* form exists only in the adjective, and in which the verbal form is constructed differently. Thus, some speakers have *learned* as the past form of *learn*, others have *learnt*, and still others have both, but virtually all have *learnedly* (trisyllabic)⁸. Even clearer is the case of *wed*: virtually all speakers have *John and Mary were wed in Pennsylvania*, but *wedded bliss*. Since the regular past form in these cases is (at least optionally, for all) formed with *+t*, as discussed above, it cannot be that these adjectives are simply participles which are exceptions with respect to syncope. It seems clear that we must recognize in the synchronic grammar of English an adjectival derivational suffix *-ed*, with form and function similar to but not identical with that of the regular participle ending. The natural underlying representation for this ending is clearly (vocalic) *-/id/*.

The derivational ending *-ed* just discussed does lose its vowel under some circumstances. Thus, in forms like *determinedly, hurriedly, astonishedly, embarrassedly*, and others it has the same (non-syllabic) form as the verbal ending. The generalization here, suggested by Jespersen, is that the non-syllabic form appears after unstressed syllables, while the syllabic form appears after stressed syllables. This is confirmed by the existence of other endings which show a similar pattern. Thus, *-ery* in nouns also shows an alternation between forms with and without the initial vowel: compare *cookery, bravery, treachery, butchery*, *adultery, embroidery, artillery, millinery*, *with burglary, husbandry, gallantry, chemistry, imagery*, etc. Jespersen also mentions *-en* in participles, verbs, adjectives, etc. as subject to this principle. There is apparently a rule in English by which unstressed *<at* at the beginning of (some) derivational endings is lost after an unstressed syllable. This principle is not, however, sensitive to the point of articulation of the preceding consonant: thus, in the list of *-ery* words above, the vowel is lost after *r, d, t,* and *(j) (= ge)* when these are preceded by unstressed vowels; but preserved after *k, v, ch, t, d, l,* and *n* when these are preceded by stressed vowels. It is thus clear that this vowel loss rule could not plausibly be extended to account for vowel loss in past forms of verbs (if */id/* were taken to be the ending there), since this latter vowel loss would have to be sensitive to preceding consonants, but not to the stress of the preceding vowel.

Now notice that adjectival forms in *-ed* never lose their vowel after a dental stop: cf. *limitedly, covetedly*, and others. On an analysis involving *-/id/* as the representation of the past ending in verbs, and the rules in (1), this would result in the following situation: rule (1) is restricted so as not to syncopate a vowel between two dental stops. The rule which syncopates vowels in derivational formatives after unstressed vowels would have to be similarly restricted. Clearly, both of these restrictions are aspects of the same fact; but the two rules must be distinct. The restriction cannot, therefore, be expressed in one place⁹. On the other hand, suppose that we represent the regular past ending as *i/d/* and the adjectival derivative suffix as *i/d/*, and employ the rules in (2). These rules do not apply to underlying *i/d/* and so no syntactically conditioned exceptionality is required to differentiate e.g. a *learned professor* from
a professor who has learned. Further, no restriction need now be placed on the rule which drops reduced vowels in derivational affixes after an unstressed syllable: in *covetedly*, whose underlying form is (essentially) /kɔvɪt#d#lɪ/, syncope applies, to give /kɔvɪt#d#lɪ/, but now epenthesis (2a) applies, to restore the vowel and give [kɔvɪtɪdli] eventually. The fact that adjectival -ed does not lose its vowel after a dental stop regardless of the stress on the preceding vowel is now naturally expressed as the same fact as that governing the distribution of the regular dental past ending in verbs. This analysis, then, gives substantial support to the non-syllabic analysis of the dental past ending, and to a set of rules like (2).

We conclude, then, that both the -s-ending and the dental stop past ending should be assigned non-syllabic basic forms, and that rules of epenthesis and progressive voicing assimilation should be present in the grammar. In the case of the -s-ending, only one of the alternants (/z/) appears as a basic form, therefore. In the case of the dental past ending, all three alternants appear as basic forms, but with different functions: /d/ is the regular past, added after word boundary; /t/ is an alternate past formative, added before word boundary and separated from the root only by +; and /d/ is an adjectival derivational formative, also added after word boundary. Our choice of the voiced forms /d/ and /z/ rather than the voiceless form /t/ and /s/ for the inflections has not been justified here, and the only argument that appears to exist is one based on transparency like those of Hockett and Basboll: since a rule devoicing an obstruct after a voiceless obstruct is motivated by a surface phonetic pattern, while a rule voicing an obstruct after a sonorant (as well as after a voiced obstruct) is contradicted in surface phonetics by numerous instances of post-vocalic [t], [s], etc., the former rule is clearly preferable in some sense; and this leads to the analysis with voiced basic forms. Whatever indeterminacy may remain on this point, however, it has been demonstrated here that only the non-syllabic possibilities (/z/ and /d/ or /s/ and /t/) can be seriously entertained.

**NOTES**

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1. There is, of course, a tremendous amount of variation, both dialectal and individual, in the pronunciation of unstressed reduced vowels in English. This is irrelevant to the points discussed in this paper, and all such reduced vowels have been transcribed as *a*.

2. Of course it is possible that the basic form is some shape that does not occur phonetically at all; but no arguments for this position have ever been produced, and we assume that basic forms are phonetically occurring ones except where positive arguments for some non-occurring form exist.

3. The structure of such rules is assumed to be familiar. The use of Greek letter variables in rules (1a), (2a), and (3a) expresses the requirement that the corresponding features must all agree in value in both occurrences (in (2a) and (3a)); or that at least one of them must have different values in its two occurrences (in (1a)). (2a) and (3a) apply whenever the two consonants in the environment agree in the relevant features, and thus are either both dental stops or both sibilants; while (1a) applies exactly when this condition is not met.

4. We say these speakers *claim* this, because phonetically it is not the case. Phonetically, final *s* in both *races* and *raises* is lax and partially devoiced, as is generally the case for obstruents in final position after a reduced vowel in American English. Thus, the difference between these speakers (of whom the author has uncovered four or five in his classes, in addition to his wife) and speakers of the standard form of American English is a difference neither of underlying forms (presumably identical for all), nor of surface phonetic forms (demonstrably identical), but rather of an intermediate level of representation. This is what we would expect in such a case, where the interaction of two rules is significant, but where all evidence for their ordering is later wiped out by some other process (in this case, the neutralization of obstruct voicing distinctions finally after reduced vowels). The rules must be ordered one way or another, but which order is chosen is only significant in intermediate representations. The fact that this difference is perceptually real (to the speaker, of course) is interesting evidence for the correctness of a phonological theory in which such intermediate representations exist.

5. The -en ending of participles like *ridden*, *broken*, etc. is also a suffix of course, but we are not concerned with the rules for this formative here. Rules are given to account for most instances of the ending by Jespersen.

6. The major exceptions are verbs like *catch/caught*, *bring/brought*, *seek/sought*, *buy/bought*, and others. Most of these once ended in velar plus *t*, though the consonant alternations are not very transparent now.

7. Forms like *middle-aged* are quite distinct. These are built with the ending *d/ added to nouns, having a sense like 'endowed with or characterized by ___'. Other examples of this formation are *gabled, thatched-roofed, three-legged, hard-covered,*
polka-dotted, etc. Some of these (e.g. three-legged) are evidently formed with /d/ instead of /d/, but are otherwise the same.

8. A few speakers have monosyllabic learned adjectively, but (usually) tri-syllabic learnedly.

9. As Kisseberth (1970) has demonstrated, it is possible for several rules to 'conspire' to maintain some generalization. An analysis on which a given generalization is stated only once in the grammar is still, we assume, preferable to one in which it re-appears at more than one point, ceteris paribus.

References:

*Harvard University and Copenhagen University.*

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**Three Poems**

by

PATRICIA WOOD

He was a good man
and a lord
on his own land
and little by little laid claim
to a glowing hoard of gold.

As I hovered near his gate
watching him at work
I saw a bird in a Persimmon tree
'You've got a Waxwing, there,' I said.

He lost the mood for his work
He let his head go free
and crossed the gate to see the Waxwing
in the Persimmon tree.

And it was good
to stand apart, and joyful together.
But now, whether or not I mind,
I find he doesn't love the Waxwing
in the Persimmon tree.
He loves me.