

ENGLISH PAST AND PERFECT VERB INFLECTION

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An autosegmental account of English past and perfect verb inflection is presented. A total of 21 rules of three basic types is required. There are 4 suffixation rules, each of which is made up of from two to five subrules; one of these rules, -ed, is the only major rule in this portion of English verb morphology. There are 15 ablaut rules, which replace a portion of the syllable of the base with segments specified in the rule; 10 rules replace the vowel of the base, 2 rules replace the rime, and 3 rules replace the entire syllable. There are 2 deletion rules, one of which deletes a syllable coda and the other of which deletes a vowel. A given inflected form may undergo one of these rules, or may combine a suffixation rule with a rule of another type. These rules represent a very concrete approach to the English verb system, and account for all the facts more simply and with fewer rules than an abstract approach.

0. Introduction.

There are many different ways in which the past or perfect form of a verb can be created in English. As each new phonological theory has arisen, the facts have been redescribed from the new point of view. Traditional grammarians simply listed the occurring forms. American structuralists such as Twadell (1947) attempted to describe the regularities by giving each verb a set of allomorphs. Generative phonologists such as Chomsky and Halle (1968) and Hoard and Sloat (1973) gave a set of extremely abstract phonological rules that changed the features of underlying vowels in a series of steps leading eventually to the surface form. While natural generative phonologists never fully described the verb system, it is clear that they would have placed phonological alternatives as disjunctive choices within a single lexical entry, as in Hudson (1975) and Hooper (1976). More recently, many linguists have come full

circle and argued that all irregular forms are represented suppletively in the lexicon. In this paper, I will present a full analysis of English past and perfect forms from the point of view of autosegmental morphology, as proposed by Stemberger (1981a) and McCarthy (1981).

1. What's in the Lexicon?

Chomsky and Halle (1968) assumed that the lexicon was made up completely of morphemes. An irregular inflected form such as sang was not listed in the lexicon. Rather, an independent phonological rule, a minor rule sensitive to lexical marking, applied to the base. More recently, linguists such as Jackendoff (1975), Aronoff (1978), McCarthy (1979), and Bybee and Brewer (1981) have argued that all irregular forms are listed in the lexicon, with their own lexical entries. Bybee and Brewer also maintain that regular forms that are frequent appear in the lexicon; the others argue that all regular forms are listed in the lexicon, except for rare nonce forms that are actively created. Bybee and Brewer do not commit themselves to the form of lexicalization for these independent lexical entries for inflected forms, but Jackendoff and Aronoff both argue for full suppletion. Aronoff's argument is that if any form at all can be shown to be fully suppletive, such as go and went in English, then all inflected forms must be fully suppletive. This is obviously a very weak argument. Jackendoff has no argument for full suppletion in inflection; he maintains that the existence of derived forms that contain a nonword base, such as the derived nominal surveillance (but *surveil), argues for full suppletion. An alternative to full suppletion would be to represent the independent lexical entry for an inflected or derived form as the base word and all rules that apply to it. This cannot be so with surveillance, since there is no base word to derive it from; if we posit a lexical entry for a base word, there would be no way to keep it from being used. Hence, all independent lexical items are fully suppletive. Stemberger (1982b) shows that this argument is fallacious, depending on an incomplete and inadequate view of lexical insertion. Stemberger goes on to show that there are patterns evident in naturally occurring speech errors that cannot be explained by full suppletion. They can only be explained if there are minor rules that apply to the base word for both inflectional and derivational morphology. In addition, there is also a great deal of evidence that irregular forms are separately listed in the lexicon. Thus, there will be a separate lexical entry for a word like sang, but it will be a minimal entry. The entry states that the base form sing is to be selected, and a particular process is to be performed on it to yield the surface form. It is the purpose of this paper to describe the form of such minor rules, as well as the major rules of the language. We will see that

suppletion is a gradient phenomenon, with minor rules representing a slight degree of suppletion, and fully suppletive forms like went representing the extreme endpoint of the continuum.

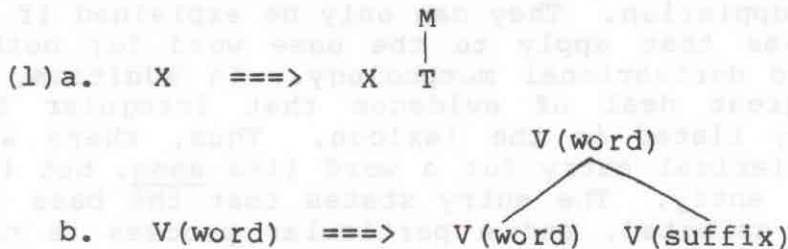
2. The Rules of English.

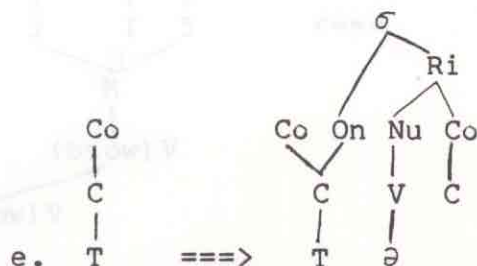
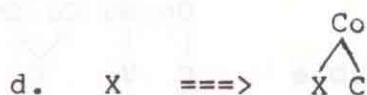
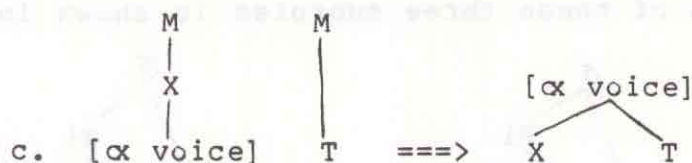
English has several types of rules. First, there are the suffixation rules. Each of these rules is organized as a group of subrules. Some of these subrules are used in more than one suffixation rule, and it is assumed that the subrule is listed only once in the lexicon. Each suffixation rule is marked to access a particular set of subrules (Stemberger 1981a). Some of the subrules always add material to the base form, but several can apply vacuously. Secondly, there are the "ablaut" rules, that replace a part of the base with material from the rule. Such rules can affect the vowel, the rime, or the entire syllable. Lastly, and very marginally, there are rules of deletion.

2.1 Suffixation Rules.

There are four suffixation rules evident in English past and perfect tense forms. The main rule is the only major rule found in this part of the morphology, the -ed suffixation rule. A second rule suffixes -en. A third rule is similar to the -ed rule, but can apply vacuously. The fourth rule suffixes -t to the base, either in full or semi-vacuously.[1]

The -ed rule represents the general form of affixation rules within the autosegmental framework of Stemberger (1981a). Every rule has several subrules, which apply either simultaneously or in intrinsic order. There are five subrules here. One subrule is required to spell out the phonological material in the affix (1a) [2], one is required to build the hierarchical morphological structure that orders the base and the suffix (1b), one subrule is needed to integrate the archisegment of the affix with the preceding phonological material (1c), and two subrules are required to integrate the affix with the syllable structure of the base (1d-e), of which only one will apply in any given form.[3]

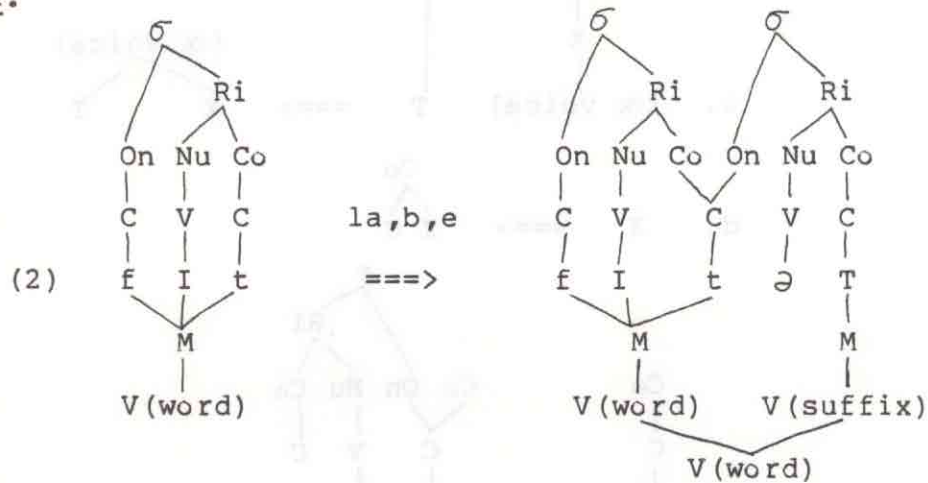




Note that only the first two subrules are directly involved with the morphological and phonological makeup of the suffix itself. The other three subrules are required only to integrate the suffix with the material of the base. These rules have thus been called "phonotactic" by Linell (1979) and Hudson (1980), rather than "morphological" as done here. They are, however, an integral part of this morphological rule; subrule (lc) must apply whenever this rule applies, and either (ld) or (le) must apply in all forms. These subrules are thus as frequently associated with the *-ed* rule as the two purely morphological subrules are. A psychologically valid theory of learning (Norman and Shallice 1980, Stemberger 1982b, Bybee and Brewer 1981) would find it inconceivable that these three subrules were not explicitly made a part of the rule. McCarthy (1979, 1981) also argues that the syllable structure produced by the rule must be an integral part of the rule and included in the formalization of the rule. This follows partly from the assumption that the syllable structure of a word is stored with that word in the lexicon, rather than derived by rule (Kaye 1980). There is no reason to set aside the three subrules (lc-e) as special. I include them here as equivalent subrules to the morphological subrules, as Stemberger (1981a) also does.

These subrules are applied simultaneously wherever possible, and in intrinsic order otherwise. Subrules (ld) and (le) are disjunctively ordered. Subrule (le) is more specific, and hence applies if it can (Koutsoudas et al. 1974); subrule (ld) only applies if (le) cannot. Subrules (la,b,d) or (la,b,e) apply to the base verb simultaneously. They create material on three distinct autosegmental levels (morphemic, segmental, syllabic); this material is linked up correctly on the basis of universal autosegmental conventions on the association of different autosegments. The

application of these three subrules is shown in (2) for the word fit.

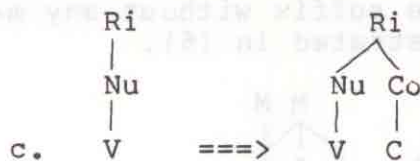


Only at this point, after the archisegment of the suffix has been integrated with the syllable structure of the base, can subrule (1c) apply, since it relies crucially on the segment which precedes the archisegment; what segment is the preceding one is not determined until the application of subrule (1e), in this example. Subrule (1c) takes the feature [+voice] from the preceding shwa and creates an autosegmental tier containing it; this autosegment maintains its connection with the vowel and is in addition attached to the archisegment /T/, which will now be pronounced as a /d/. While the shwa introduced by subrule (1e) belongs to no morpheme, all other segments in this position in the word belong to the morpheme of the base. When the feature [α voice] is raised to its own autosegmental tier out of a segment of the base, it retains its morphemic relationship to the base morpheme, and does not belong to the affix (Stemberger 1980), as shown in (3) for the word rig.



The second suffixation rule is that for the perfect (and passive) suffix -en, which appears in 41 English verbs. It is a minor rule, and is more or less nonproductive, only rarely being extended to new verbs. This rule has four subrules (4).

- (4) a. X ==> X $\begin{matrix} M \\ | \\ n \end{matrix}$
- b. SAME AS SUBRULE (1b)



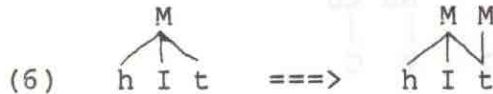
All subrules apply simultaneously. Subrule (4a) introduces the phonological material of the suffix, which in this case contains a full segment rather than an archisegment. Subrule (4b=1b) introduces the morphological structure of the inflected form. I assume that this subrule is listed only once in the grammar, and is accessed by both these rules. Subrule (4c) integrates the /n/ of the suffix with the syllable structure of the base by making it the syllable coda only if the base lacks a syllable coda. If the base does have a syllable coda, subrule (4d) applies to make the /n/ of the suffix the nucleus of its own syllable.[4] Only subrule (4c) or (4d) can apply in a given word. There is no need for disjunctive ordering, however, since the environments for the two rules do not overlap.

The third suffixation rule of English applies in both past and perfect forms to affix -ed to the base form, sometimes fully and sometimes vacuously. It contains at least two subrules, of which one is subrule (1b). If the rule sometimes applies fully, then subrules (1c-e) will also be needed. The other subrule, given in (5) differs minimally from subrule (1a).



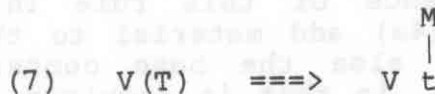
Stemberger (1981a) discusses rules of this form extensively, and argues for the existence of this rule in English. Subrules such as (1a) and (4a) add material to the end of the base, no matter what else the base contains. The subrule in (5) is different, in that it requires only that the output of the rule end in the archisegment /T/ (or the segments /t/ or /d/). This may be achieved either by adding the morpheme /T/, or by assigning the function of the suffix morpheme to the stem-final /t/ or /d/. Such reassignment of function without adding any new phonological material is essentially a form of vacuous application of a subrule. If this subrule were to apply to a base such as rig which does not end in a /t/ or /d/, it would add the suffix to produce rigged. If the base ends in /t/ or /d/, however, such as in the word hit, the stem-final /t/ will be assigned the

function of the past tense suffix without any material being added or changed, as illustrated in (6).



This rule is designed to account for the 28 English verbs that end in /t/ or /d/, and appear unchanged in the past and perfect forms. These 28 verbs are lexically marked to undergo this rule, and access it as a minor rule. The rule is only marginally productive. However, the way that subrule (5) is stated can also account for all the regular verbs of English that do not end in /t/ or /d/. There is no way to tell if any of these verbs undergo subrule (5) rather than subrule (1a); hence, it is impossible to say how widespread this rule is in English. If (5) can apply fully to some verbs, then subrule (1c) must be a part of this minor rule. Subrule (1c) cannot apply to forms such as hit, however, to produce the incorrect form hid. Note that the environment for (1c) is not met here; the subrule requires that the archisegment /T/ belong wholly to the suffix and that it not belong to the previous morpheme, which is not the case here. Lastly, it is possible that words such as hit, which end in a /t/, might be accounted for by the remaining suffixation rule of English.

The fourth, and last, suffixation rule for past and perfect forms suffixes -t to the base, either vacuously, semi-vacuously, or possibly fully vacuously. This rule is completely nonproductive. The inflected forms of the 11 verbs that undergo this rule are listed in the lexicon, and access the rule as a minor rule. The rule contains three subrules. Subrule (7) suffixes -t to the base. The second subrule, (1b) above, accounts for morphological structure. The third subrule, (1d) above, integrates the phonological material of the suffix with the base; it applies only if the /t/ has been fully added, and does not apply in the case of vacuous and semi-vacuous application of subrule (7).



This rule is intended to account for two groups of verbs in English. One group of verbs adds -t, either to the base form (only the verb burn in my dialect) or to the ablauted verb base (the 5 verbs dream, deal, feel, kneel, mean). The second group of verbs shows the change of a word-final /d/ to a /t/, i.e. shows the semi-vacuous application of the rule where a word-final alveolar stop is taken as satisfying the rule, and is made into a /t/; there are 5 such verbs (bend, build, lend, send, spend). Both these groups have a

nasal or lateral sonorant preceding the /t/ of the suffix, increasing our confidence that the same rule is involved with both groups. Rule (7) also applies in a twelfth form: lost. The base lose ends in a /z/ which devoices to /s/ before the /t/ of the suffix. This devoicing will require an additional subrule for (7) that takes the feature [-voiced] from the /t/ and raises it to an autosegmental tier dominating the entire syllable coda. The subrule will be similar to (1c) except for the source of the autosegment, and is also used in many dialects in derived forms like width.

2.2 Ablaut rules.

There are many ablaut rules in English. In these rules, the subrule that is responsible for integrating the material of the affix with the syllable structure of the base requires that the phonological material of the affix occupy certain syllable positions. The syllable positions for some of the material of the base are usurped, and that material does not show up on the surface. Ablaut can affect the vowel of the base, the final consonant, the entire rime, or the entire syllable. As we will see, there is no reason to assume that the existence of such rules leads to any abstractness in the derivation of the inflected forms.

2.21 Vowel Rules.

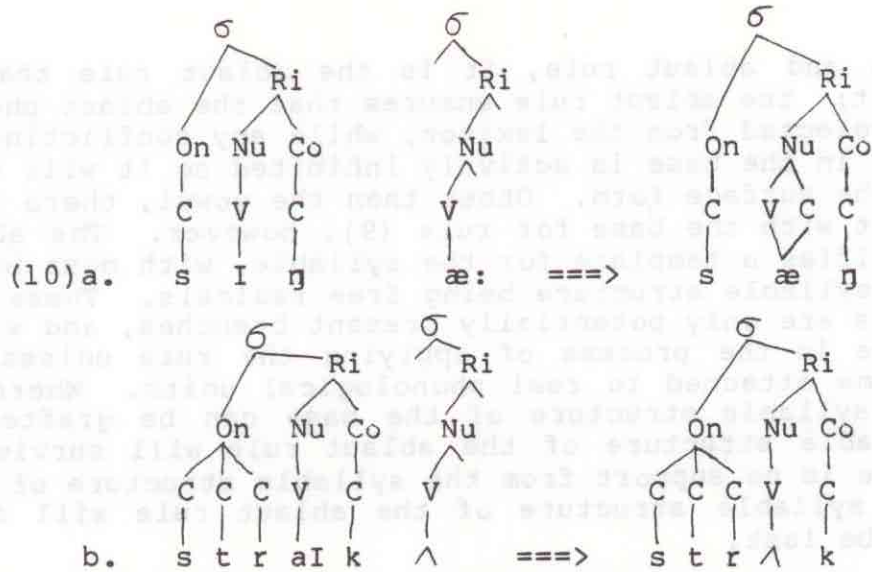
There are 10 different vowel ablaut rules in English. Two of these rules are associated with past tense forms (/u:/, /U/), while the other rules are used in both past and perfect forms. However, even these two rules can be used in the perfect tense, since any past tense form in English can be used as a perfect form, at least colloquially, as in (8).

(8) I shoulda took a couple more.

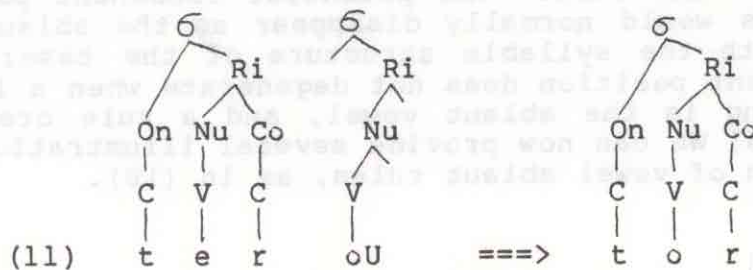
The large number of rules is of interest, since, in this analysis, English has only 14 vowels (/i:, I, eI, e, æ:, u:, U, oU, a:, ^, ə, aI, oI, æU/). [5] These rules cannot be reduced in number by positing abstract underlying forms and stating the rules in terms of minimal feature changes, as attempted by Chomsky and Halle (1968) and Hoard and Sloat (1973). To account for the same phenomena that I account for in this and the following sections with 17 ablaut rules, Hoard and Sloat require 25 rules, 16 of which are needed only for the past and perfect forms of verbs, many of which are complex. The contrast between the two solutions is heightened when the derivation of a given form is considered. While only one rule is needed to derive any given form here, Hoard and Sloat require up to seven or eight rules to derive the surface forms of some verbs. It is simpler and more efficient to assume that the rule specifies the ablaut vowel in its surface phonemic form, and

base and ablaut rule, it is the ablaut rule that is dominant; the ablaut rule ensures that the ablaut phoneme will be selected from the lexicon, while any conflicting information in the base is actively inhibited so it will not appear in the surface form. Other than the vowel, there is no conflict with the base for rule (9), however. The ablaut rule specifies a template for the syllable, with most branches of the syllable structure being free radicals. These free radicals are only potentially present branches, and will degenerate in the process of applying the rule unless they can become attached to real phonological units. Where parts of the syllable structure of the base can be grafted on, the syllable structure of the ablaut rule will survive; where there is no support from the syllable structure of the base, the syllable structure of the ablaut rule will degenerate and be lost.

Before we can illustrate this blending, however, it is necessary to discuss how the syllable structure of long vowels and diphthongs is created. Stemberger (1982c) has shown that the syllable structure of long vowels and diphthongs is present in the base syllable structure stored with the lexical item in Swedish and German. In English, however, the structure of long vowels and diphthongs appears to have been "segmentalized", made an integral part of the vowel itself. Therefore in English, as far as the base syllable structures stored with the word in the lexicon is concerned, long vowels and diphthongs occupy a single vowel position. However, a phonological rule is present that modifies the base syllable structure. Such segments as /i:/ and /aI/ modify the syllable structure so that it contains both a vowel and a consonant position within the syllable nucleus. The vowel portion of a diphthong is attached to the strong position, while the glide part is attached to the weak position; the vowel of a long vowel is attached to both positions. This is relevant here, because the vowel /æ:/ in rule (9) occupies only the vowel position in the statement of the rule. The potential consonant position in the nucleus would normally disappear as the ablaut rule is blended with the syllable structure of the base; however, the consonant position does not degenerate when a long vowel or diphthong is the ablaut vowel, and a rule creates that position.[6] We can now provide several illustrations of the application of vowel ablaut rules, as in (10).



This characterization of diphthongization has one further ramification for vowel ablaut rules. The consonant position in the syllable nucleus in English is not used solely by long vowels and diphthongs. It can also be occupied by the consonants /r/ and /l/ (Stemberger 1981b, 1982c), as in such words as fear and fill. There are four ablaut verbs which have the consonant /r/ in the syllable nucleus: bear, swear, tear, and wear. All four verbs take the ablaut vowel /oU/. As the ablaut structure and the syllable structure blend together, the ablaut vowel /oU/ replaces the vowel of the base, /e/; the /r/ of the base, which occupies the consonant position of the syllable nucleus is unaffected. The ablaut vowel then attempts to modify the syllable structure to provide a consonant position in the syllable nucleus for its glide to occupy. However, that position is already present and occupied. No position can be provided for the glide portion of the diphthong; it is, therefore, inhibited and never shows up in the surface form of the word. Only the vowel portion /o/ of the diphthong is produced. This is illustrated in (11) for tear. [7]



There are ten different vowel ablaut rules for past and perfect forms in English, all with the same structure and processes, differing only on the identity of the ablaut vowel. There is thus no need to illustrate the operation of all the rules, and I will only list them here, with examples in parentheses. The ablaut vowel /ʌ/ is used in 18

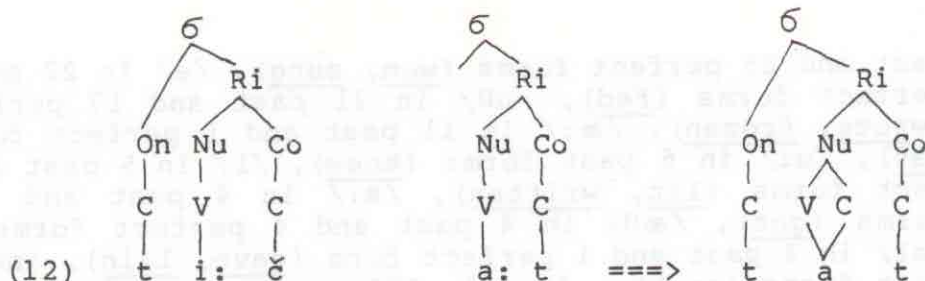
past and 25 perfect forms (won, sung), /e/ in 22 past and 21 perfect forms (fed), /oU/ in 21 past and 17 perfect forms (wrote, frozen), /æ:/ in 11 past and 1 perfect form (sang, sat), /u:/ in 6 past forms (knew), /I/ in 5 past and 9 perfect forms (lit, written), /a:/ in 4 past and 5 perfect forms (got), /æU/ in 4 past and 4 perfect forms (found), /eI/ in 4 past and 1 perfect form (gave, lain), and /U/ in 2 past forms (took). In all, 180 past and perfect forms use a vowel ablaut rule. However, some of these forms also undergo one of the affixation rules. There are 7 past and 4 perfect forms which show both ablaut and -ed, such as sold and kept. There are 6 verbs whose past and perfect forms show both ablaut and -t, such as felt and lost. There are 22 perfect forms that show both ablaut and -en, such as written. In all, 45 forms show a suffix either optionally or obligatorily.

Before leaving vowel ablaut rules, it may be of interest to make one last comment about abstract underlying forms. In the normal interpretation of rules, ablaut rules might imply some abstractness in the derivation of inflected forms. For example, the vowel /I/ might appear in the underlying form of the word sang, even though there is no evidence in the surface form that bears witness to that fact. However, such abstractness is not true of the system described here. I assume that the blending of the syllable structures of the base and ablaut forms occurs during the process of accessing a lexical item in the lexicon. The replacement of the base vowel /I/ with the ablaut vowel /æ:/ occurs before the vowel /I/ has been accessed. In this respect, the rules as used here resemble the disjunctive underlying forms of Hudson (1975, 1980) and Hooper (1976) in natural generative phonology and nongenerative phonology. In this autosegmental system, we can achieve the concreteness of Hudson's approach while still maintaining the existence of rules.

2.22 Rime Ablaut.

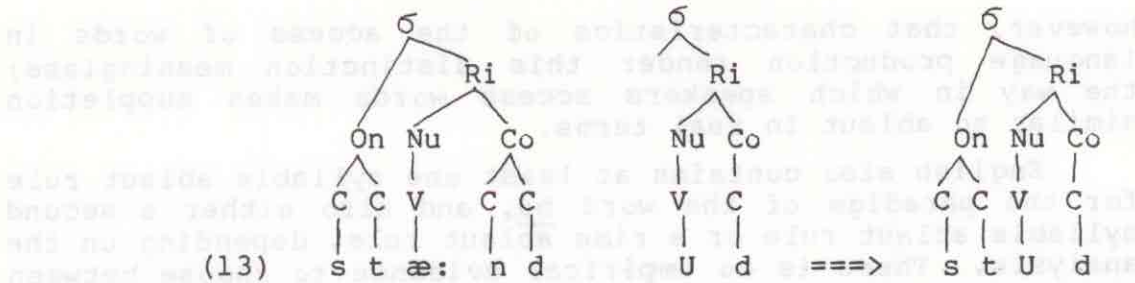
There are two rules for the past and perfect forms in English that can be viewed as a type of rime ablaut. With both these rules, the syllable onset of the base is unaffected by the rule, but the rime of the base is replaced by the rime specified in the ablaut rule.

The first and most widespread rule of rime ablaut replaces the rime with /a:t/. It is illustrated in (12) for the word teach. (I include here the modification of the syllable structure by the long vowel.)



Note that the effects of this rule could seemingly be reduced to the effects of the /a:/ ablaut rule and the /t/ suffixation rule in (7). However, there are reasons for not doing this. First, note that all the past and perfect forms that are created by the /t/ suffixation rule contain both a sonorant consonant and /t/ in the rime. The six forms created by (12) (bought, brought, caught, sought, taught, and thought) do not fit this canonical shape. Secondly and more importantly, the rule in (7) will have to be severely modified, and broken up into several rules, to extend to these forms. Rule (7) does change other consonants into /t/, but only if they are already an alveolar stop; all the forms listed above end in other consonants. Rule (7) does not delete postvocalic nasals, as demonstrated by dreamt and sent; it is impossible to account for the deletion of the nasals in bought and thought by the same rule. Since a separate rule is required to account for these forms, we may as well treat it as rime ablaut, recognizing the fact that the vowel /a:/ is closely tied to the rule, and no other ablaut rule is. Note that there is no way to tell if the forms got, shot, and fought, which correspond to the base forms get, shoot, and fight, undergo the vowel ablaut rule /a:/ or the rime ablaut rule /a:t/, since the bases end in /t/. We will discuss such indeterminacies, and their resolution, below.

The second rime ablaut rule is used by only one past/perfect form: stood. In this form, the base vowel /æ:/ is replaced by the vowel /U/, and the nasal /n/, but not the stop /d/, of the coda is deleted. If /n/ were a part of the syllable nucleus with the vowel, it would be very simple to state this rule. However, it is not. The rule must delete one of the consonants of the coda without affecting the other, and it is difficult to do this. We must treat this as a change of the entire rime. I assume that the /d/ of the coda is specified in the rule, as in (13), but it is possible to consider the /d/ as an affix due to rule (1); I do not like that alternative, but have no data to argue against it.

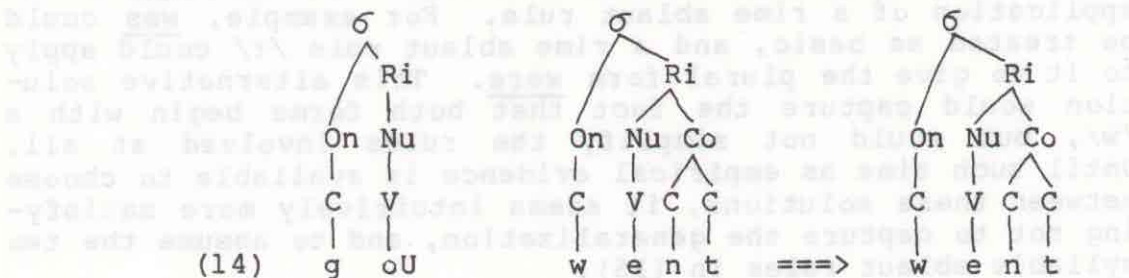


Rule (13) can also be used for the (in some analyses) past tense forms of the modals can, will, and shall: could, would, should.

2.23 Syllable Ablaut.

There are several rules of syllable ablaut in English, where the rule specifies the entire syllable of the inflected form. There are no syllable positions remaining for any of the material of the verb root, none of which appears on the surface. These rules represent the fully suppletive forms of English verb inflections. There are at least two syllable ablaut rules, and possibly three.

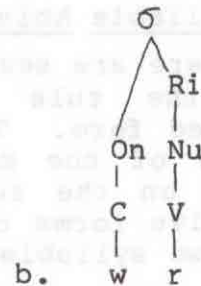
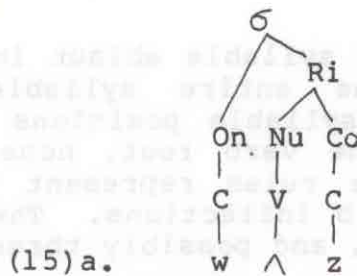
The most popular example of a syllable ablaut rule is the one that produces went, the past tense form of the base word go. We can illustrate this rule as in (14).



Note that full suppletion is represented in essentially the same form as vowel ablaut. In fact, we can set up a continuum of suppletion. In some forms, there is no suppletion since all of the base is used in the inflected form, as in (1). In other rules, there is a small amount of suppletion, since part of the base is replaced by material from the affix, such as the vowel of (9). Some rules show more suppletion, since the entire rime is replaced, as in (12-13). Other rules show yet more suppletion, replacing entire syllables, as in (14). The most extreme case of suppletion in English involves syllables; it is possible to have suppletion rules that replace groups of syllables as well, but English lacks such rules. There seems to be no intrinsic difference between suppletion and ablaut in the framework assumed here. Stemberger (1982b) has argued for this point in more detail. He notes that it would be possible a priori to argue that full suppletion does not involve the base form at all, while vowel and rime ablaut does. He points out,

however, that characteristics of the access of words in language production render this distinction meaningless; the way in which speakers access words makes suppletion similar to ablaut in real terms.

English also contains at least one syllable ablaut rule for the paradigm of the word be, and also either a second syllable ablaut rule or a rime ablaut rule, depending on the analysis. There is no empirical evidence to choose between these alternatives, and I will assume two syllable ablaut rules for the moment. The rule for was is presented in (15a), and the rule for were is presented in (15b); both rules will inhibit the base form be, in a derivation similar to that in (14).



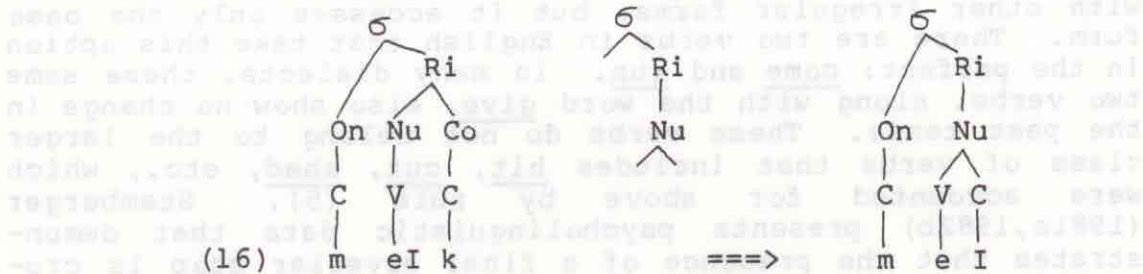
It would be possible to treat either (15a) or (15b) as the basic rule. The other rule could then be treated as the application of a rime ablaut rule. For example, was could be treated as basic, and a rime ablaut rule /r/ could apply to it to give the plural form were. This alternative solution would capture the fact that both forms begin with a /w/, but would not simplify the rules involved at all. Until such time as empirical evidence is available to choose between these solutions, it seems intuitively more satisfying not to capture the generalization, and to assume the two syllable ablaut rules in (15).

2.3 Deletion Rules.

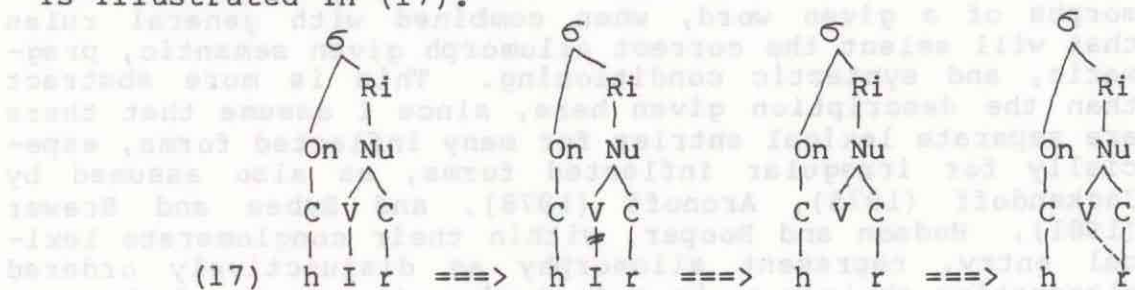
There are two deletion rules used to form past or perfect forms in English. They are of two distinct types. One rule deletes a syllable coda, and must be viewed as a special type of rime ablaut. The other rule deletes a vowel. These deletion rules are marginal in English in that they are used by very few words.

There is a syllable coda deletion rule that is used in the past and perfect forms of two words: make and have. The past and perfect forms of these verbs are made and had, which show the deletion of the bases' stem-final consonants /k/ or /v/, plus the addition of the regular -ed suffix (by rule (1)).[8] This deletion can be treated as a special type of rime ablaut. The rule provides a syllable structure that does not contain a syllable coda, and that introduces no segments of its own. The consonant /v/ of have and the /k/

of make cannot attach to a syllable position, and hence do not appear in the surface form; syllable positions for all other segments of the base are provided, however, and they appear as usual. This is illustrated in (16), producing a form that will (simultaneously) undergo rule (1) in the usual fashion. (I also include the modification of the nucleus by the vowel to include a consonant position.)



There is also one vowel deletion rule: the rule responsible for the word heard, past/perfect form of the verb hear. In addition to the application of rule (1), this form shows the loss of the base vowel /I/ with a concomitant change whereby postvocalic /r/ has become syllabic. Unlike the previous deletion rule, the syllable structure of the word is unaffected by the rule; both the base and the inflected form have a nucleus composed of a vowel and a consonant position. The deletion rule deletes only the vowel, leaving its associated syllable position on the CV-tier intact and associated with no segment; this is accomplished simply by breaking the link between the segment /I/ and its associated V on the CV-tier. In autosegmental theory, every syllable position must be associated with at least one segment if it can be; in addition, segments can be associated with several syllable positions, as noted above for long vowels. When the vowel of hear is deleted, an unassociated vowel position is created. The postvocalic /r/ of the syllable nucleus is still present. Since /r/ can occupy the vowel position of the syllable nucleus, it becomes linked to that position by the usual conventions of autosegmental theory. The result is a long syllabic /r/. This derivation is illustrated in (17).



This is the only rule needed to account for the past and perfect forms of English that utilizes the automatic spread of association lines between units on different

autosegmental tiers.

2.4 Nothing.

There is one other option available in the formation of past/perfect forms in English: nothing. The inflected form can consist of only the base, without the application of any rule. The inflected form must be listed in the lexicon, as with other irregular forms, but it accesses only the base form. There are two verbs in English that take this option in the perfect: come and run. In many dialects, these same two verbs, along with the word give, also show no change in the past tense. These verbs do not belong to the larger class of verbs that includes hit, cut, shed, etc., which were accounted for above by rule (5). Stemberger (1981a, 1982b) presents psycholinguistic data that demonstrates that the presence of a final alveolar stop is crucial to the forms undergoing rule (5), and that this rule is distinct from doing nothing. Thus, the verbs discussed here must belong to a (very small) class of their own.

2.5 Discussion.

The rules that I have presented are sufficient for creating all the regular and irregular past and perfect forms in (American) English. Given that such rules exist, as argued by Stemberger (1982b) on the basis of psycholinguistic evidence from spontaneous speech errors arising in language production, these rules account for the facts with a minimal number of rules in a simple fashion, without unwanted abstractness. There are 4 suffixation rules, 10 vowel ablaut rules, 2 rime ablaut rules, 3 syllable ablaut rules, and 2 deletion rules; 21 rules in all. A few additional comments are necessary.

I have shown that it is possible to describe the facts of English past and perfect inflection without much abstractness, by taking an approach at least as concrete as that of Hudson (1975, 1980) and Hooper (1976), if not more so. These researchers assumed a single lexical entry that contains all the information needed to produce all allomorphs of a given word, when combined with general rules that will select the correct allomorph given semantic, pragmatic, and syntactic conditioning. This is more abstract than the description given here, since I assume that there are separate lexical entries for many inflected forms, especially for irregular inflected forms, as also assumed by Jackendoff (1975), Aronoff (1978), and Bybee and Brewer (1981). Hudson and Hooper, within their conglomerate lexical entry, represent allomorphy as disjunctively ordered alternative choices to be made during the access of the morpheme. In my description, the alternative is chosen by the lexical entry for the inflected form. The lexical entry for sang, for example, determines that the nucleus of the

syllable will be /æ:/, leaving no room for the base vowel /I/ and inhibiting it, so that it will not appear on the surface. If we assume that the ablaut rules apply during the initial accessing of the lexical item and its segments in the lexicon, no abstractness is involved; in a very real sense, the /I/ of the base is never present in the derivation of sang. Restatement of these rules in terms of features would lead to more complex rules, but could be treated exactly like rules stated in terms of segments, applying without any abstractness during the initial access of phonological information in the lexicon. The mere presence of rules says nothing about abstractness, contra Hudson (1975,1980); abstractness depends crucially on other assumptions.

One of the most disturbing aspects of the rules presented above is their indeterminacy in some cases. Some inflected forms can be accounted for by more than one of the rules, and it is impossible to determine which rule to use. For example, is /a:/ or /a:t/ used to derive shot from shoot? Is hit derived by vacuous application of -ed (rule (5)) or -t (rule (7))? This is an important psychological question, though obviously it does not effect the overall workings of the rules in question or their output, which will be the same in all cases. In some cases, apart from the psychological questions, there is minimal difference in processing between the two alternatives during language production. Consider the case of shot. Both rule /a:/ and rule /a:t/ will replace the vowel of the base, /u:/, with the vowel /a:/, with exactly the same psycholinguistic processing. If the rule /a:/ is used, the /t/ of the coda will be accessed by the base form shoot. If the rule /a:t/ is used, the /t/ would be accessed by both the base form shoot and the rule /a:t/; according to the model for the accessing of segments and features from the lexicon presented by Stemberger (1982a,1982b), there is only a single /t/ to be accessed by both these rules. In the case of shot, the /t/ would be accessed by both the base and the rule; more activation would come from the rule, but the activation from the base alone would be sufficient to access the /t/. Only if the rule and the base activated different consonants would there be a conflict, in which case the greater activation from the rule would cause the consonant of the rule to prevail. In practical terms, then, there is almost no difference between the two alternatives for shot, other than the question of psychological categorization. While the indeterminacy is still vexing, until we can obtain some empirical evidence to choose between the alternatives, we must be content to live with it.

3. Conclusion.

In this paper, I have presented a complete description of the rules for past and perfect inflected forms in

English, within the framework of autosegmental morphology. In all, 21 rules are required to generate all forms, including fully suppletive forms and other irregularities found only in single words. There are 4 suffixation rules, only one of which is a major rule; each of these rules has several subparts. All rules but one are minor rules, and all forms that undergo them must have separate lexical entries; these entries contain minimal information, stating only that the base form and at least one rule be accessed. In addition to affixation rules, there are rules of ablaut which place a vowel, a rime, or a syllable into certain positions in the syllable, displacing the corresponding segments of the base verb. Forms that undergo vowel and consonant ablaut often undergo one of the suffixation rules as well. These rules are capable of describing all the facts of English in a concrete fashion, with minimal abstractness.

Footnotes

[1] For a full discussion of vacuous and semi-vacuous rule application in morphology, see Stemberger (1981a).

[2] In the following rules, X will represent either a consonant or a vowel on the CV-tier, C a consonant on the CV-tier, V a vowel on the CV-tier or a verb in morphological structure, On a syllable onset, Nu a syllable nucleus, Ri a syllable rime, Co a syllable coda, M a morpheme, and /T/ an archisegment that is not specified for voicing and hence is nondistinct from /t/ and /d/.

[3] I assume that subrule (1e) makes the verb-final stop of the base ambisyllabic, following Kahn (1976). Note that the shwa introduced by (1e) belongs to no morpheme (M); it is present only for reasons of syllable structure.

[4] These rules support Stemberger's (1982c) suggestion that long vowels and diphthongs belong wholly to the syllable nucleus. Leben (1980) has argued that the glide of a diphthong and the extra syllable position of a long vowel belongs to the syllable coda. The words throw and give would then have parallel rimes. It is difficult to see how to reformulate these subrules in a simple fashion to predict that the /n/ of the suffix is syllabic in given but part of the coda in thrown. It is simpler to treat a diphthong differently from a consonant in the coda.

[5] Stemberger (1981c) has shown that syllabic /r/, as in bird, is a syllabic consonant, not a vowel. Many dialects also contain the long vowel /ɔ:/.

[6] It is fortunate that the weak position in the nucleus for long vowels and diphthongs is not present in the base structure. If it were, then it would not degenerate for any

ablaut vowel. The glide portion of the diphthong /aI/ would thus appear in the surface form of verbs that have short ablaut vowels, such as /ʌ/ with strike. We would have to modify the structures for short ablaut vowels to exclude this position, creating two types of vowel ablaut rules rather than one. In languages like Swedish, where the weak position in the nucleus is part of the base syllable structure, ablaut vowels never affect vowel length.

[7] The behavior of /l/ in relation to the consonant position in the nucleus is odd. It can apparently appear in the coda, as evidenced by the fact that long vowels can precede /l/; only short vowels appear before /r/. There are four ablaut verbs that contain a postvocalic /l/, and take the ablaut vowel /oU/: sell, steal, swell, sell. From the pronunciation of these forms, it is not clear whether the /l/ is occupying the weak position of the nucleus, with no glide portion of the diphthong present, or whether the glide is present and the /l/ occupies the syllable coda. If the glide is present, it suggests a readjustment of the syllable position of the /l/ after the diphthong, so that it occupies a consonant position in the coda rather than in the nucleus. Alternatively, it is possible that /l/ is in the coda in the underlying syllable structure, and is incorporated into the nucleus if the nucleus has only a vowel position.

[8] This deletion rule is also used in the 3sg.pr. form has.

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