ENGLISH PHONOLOGY WITHOUT UNDERLYING GLIDES

DISSERTATION

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For the Degree of

DOCTOR OF PHILOSOPHY

By

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This dissertation demonstrates that the optimal account of English phonology denies phonemic status to oral glides. That is, it shows that all instances of phonetic [y] and [w] are predictable by rule. These occurrences include the following: formative initial glides, such as those in *yet* and *wet*; post-consonant, pre-vocalic [w] in such forms as *quit*, *guava*, and *white* and post-consonant, pre-vocalic [y] in such forms as *cute*, *few*, *million*, *onion*, and *champion*; the [y] following the tense vowels in *bite*, *beet*, *bate*, and *boy* and the [w] following the tense vowels in *bout*, *boot*, *boat*, *cute*, and *few*; and, finally, the post-vocalic centering glide [h] in *spa*, *cloth*, *beer* [bihr], and *bear*.

A contribution to the study of the linguistic structure of English, this work is set within the theoretical framework of transformational-generative phonology as defined by Chomsky and Halle's 1968 monograph *The Sound Pattern of English* (SPE). In addition to the SPE principles of phonology and conventions of formalism, this work also accepts as being essentially correct the description of English phonological structure presented there (Chapters II-V). Specifically, in this regard, the present work treats as correct the SPE account of stress assignment, laxing and tensing rules, and consonant
analysis, including the derivation of the voiceless laryngeal glide [h] from underlying /x/.

In this study, the inventory of underlying vowels is assumed to include seven tense vowels /i e æ æ o o u/ and five lax vowels /i e a o u/. Like SPE, the occurrence of [y] and [w] following tense vowels is described by the rule of DIPHTHONGIZATION, and the [w] in C_V by a [w] INSERTION rule.

Unlike SPE, this study recognizes the existence of a number of sequences of lax vowels in lexical representations. While SPE permitted marginally the collocation of [+high] [+high] vowels (triumph, fruit), [-high] [-high] vowels (eon, chaos), and [+high] [-high] vowels (fuel, -ion, -ian), here also [-high] [+high] sequences are admitted. Such sequences are acted on by several new rules of gliding and tensing to yield derivations suggested as follows:

\[
/prei feu laud boi grou/
\]
\[
/prey fyūw 15hd bōy grōw/
\]

Also the new [i, e] GLIDING rule is an extension of the SPE rule which de-vocalizes the [i] in such forms as social, onion, and conscience. Other new rules include several gliding rules: FORMATIVE-INITIAL GLIDING, /uet/ /iet/ → [wet] [yet]; PEAK SHIFT, a rule that glides the [e] in the sequence [eu] to [ɛu], an intermediate stage in the derivation of [yũw]; and POST-VOCALIC GLIDING, which converts the second vowel to a glide in these sequences /ei au ou oi/ → [ey aw ow oy] in
such forms as prey, laud, grow, and boy. Also new are three lax vowel diphthongization rules, rules which insert [w] following lax back vowels in such forms as cute, cold, and talk. All new rules are integrated into a unified sequence of sixty-two ordered rules in a summary of rules (Chapter IV).

The new proposals, described and justified in Chapter III, have the effect of eliminating the glides [y] and [w] from the inventory of underlying phonemes of English. From this flows what is perhaps more significant: they render the feature [Syllabic] completely redundant in the lexical representations of English formatives.
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CHAPTER I

INTRODUCTION

The publication in 1968 of Noam Chomsky and Morris Halle's *The Sound Pattern of English* with its analytical penchant for a dynamic description of phonological structure prompted a considerable amount of further examination of language patterning, both phonological and syntactic. However, none of the grammars of English phonology which have been produced as a result of the new bias, including that of Chomsky and Halle themselves, has been without flaws. One particular area of weakness concerns the glides [y] and [w] in English; to date no system of grammatical analysis in the transformational generative framework of English has satisfactorily accounted for or described the distribution, function, and status of the glides [y] and [w]. This dissertation provides such an account.

The glides [y] and [w] are non-vocalic phones, produced homo-organically with, respectively, the high vowels [i] and [u]. In phonetic realizations, these glides occur in two positions: pre-vocally and post-vocally. In pre-vocalic position, both glides may appear as the initial segment of a word or a formative or may occur following one or more consonants. Some quite common words such as the examples in (1) begin with either [y] or [w].
(1) yeast, yen, yam, you, yolk, yacht, wean, win, wane, wen, wine, woo, woah, wow

Other words such as unyielding, unwind, and always contain [y] or [w] internally although these internal glides are clearly formative-initial.

The occurrence of [y] and [w] in pre-vocalic, post-consonantal position is subject to a number of co-occurrence constraints which are given in some detail in Chapter II of this dissertation. The glide [y] is found in forms which contain the surface [yaw] triphthongal sequence; such words include the examples in (2).

(2) pew, beauty, fuse, view, tube, dew, cue, news

The glide [w] in pre-vocalic, post-consonantal position most commonly follows a rounded consonant and precedes a non-rounded vowel although some exceptions to this generalization do occur; thus, [w] appears in the phonetic realizations of words such as those in (3).

(3) twin, dwell, quell, guava, swipe, sweater

In post-vocalic position, phonetic [y] and [w] form the glide element of a falling diphthong; these glides are preceded by tense vowels in surface manifestations. The glide [y] co-occurs with tense, front, non-low vowels or with tense, back, low vowels. The glide [w] co-occurs with tense back
vowels. A tense vowel grid which displays the phonetic vowel-glide sequences of English is given in (4).

(4)

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the glides [y] and [w] in reference primarily to the phonetic appearance of these phones; their chief concern at times seems to have been what symbol might be used to represent the sounds. For instance, Trubetzkoy (1939:117) employed the designations ij, ei, ai, uw, ou, and au for "vowel phonemes with a movable degree of aperture." Bloomfield (1933:90), observing that in a "succession of vowels" one of the phonemes is "more sonorous" than the phoneme which immediately follows or precedes it and that the less sonorant element is non-syllabic, posited both the Primary Phonemes [a e i o u] and the Compound Phonemes in (5).

(5) [a] buy [b] buy [i] bee [b]  
[j] boy [bo]  
[e] bay [be]  
[w] go [gow ]

Hockett (1955) and Pike (1947) both note the phonetic behavior of "glide vocoids" (Hockett, 41) or "non-syllabic vocoids" (Pike, 5), indicating a distribution both preceding and following a syllabic peak. Edgerton (1946:13-14) employs the term semi-vowels to refer to [y] and [w] and several other phones as they appear in Indo-European; Edgerton observes that "i, y, and iy are three allophones of a single phoneme . . ." (13). Trager and Smith (1951:20-24) describe the distribution and function of the semi-vowel in English. One final example is given in Jakobson, Fant, and Halle (1965), who assign the term glide to [h] and [?] but describe the distribution of the phones being signalled in this study by [y] and [w] as follows:
The vowels figure predominantly as syllabics and, vice versa, the role of syllabics is assumed primarily by vowels. Most of the vocalic phonemes occur only as syllabics. A few others, being preponderantly syllabic, lose their syllabicity in some positions. For instance, English unstressed /i/ and /u/ become non-syllabic when adjacent to any other vowel (including the stressed /i/ and /u/). . . (20).

The cited observations about the distribution of the glides [y] and [w] reflect a concern for the phonetic level of representation, a concern which characterized phonological analysis prior to the advent of generative analysis.

Chomsky and Halle in The Sound Pattern of English (1968), hereinafter cited as SPE, produced the first extensive grammar of English phonology based upon the concept of abstract or underlying phonological forms which are altered by generalized processes, i.e., phonological rules, into the phonetic representation. The SPE analysis posits an inventory of vowels for English which includes both tense and lax monophthongs. No glides (non-syllabic vowels, semi-vowels, or glide vocoids in pre-SPE terminology) exist post-vocally at the deepest or most abstract level of analysis. Rather, in certain specified environments, tense vowels are diphthongized (i.e., [y] or [w] is inserted post-vocically) and then undergo vowel shift in order to produce the observable phonetic realization. Such an analysis, for instance, combined with various stress placement and laxing rules, captures the essential relationship between such pairs of words as sane and sanity, divine and divinity.
The SPE analysis, however, contains a number of anomalies vis-a-vis the derivation of the realized diphthongs [ oy ] and [ oh ], as in boy and law respectively. Chomsky and Halle propose to derive [ oy ] from underlying /o/. However, since this segment never laxes—compare expl[oy]t-expl[oy]tation with expl[ey]n-expl[ə]nation—they are forced to complicate their laxing rules in a fairly ad hoc manner. SPE derives phonetic [ oh ] from underlying /æ/ in monosyllables, such as law and laud, and from underlying /u/ in polysyllabic stems such as August, autumn, auxiliary, augment, and paucity. Finally, as Griggs and Rulon (1974) have pointed out, the SPE account offers no plausible explanation for the ablaut relation which is observed in grow—grew, know—knew, draw—drew—draft, and see—saw, nor does it account in any way for the alternate pronunciation 1[əw]tenant—1[ef]tenant.

These problems have not gone unnoticed. Both Hoard (1975) and Halle himself (1977) have provided alternate analyses for certain of these. Dissatisfaction with both the original SPE version and with various band-aid remedies which have been proposed has led this writer to explore the possibility of recognizing the existence of underlying lax diphthongs. This analysis, first proposed by Griggs in unpublished work, involves the following underlying vowel system: seven tense vowels /I ɛ ɔ ə ʌ ʊ/, five lax vowels /i e a o u/, and five lax diphthongs /ey ew aw oy ow/. The diphthongs occur in these examples.
Tenseness of the vowels in the phonetic level Griggs accounts for by positing late (i.e., post-VOWEL SHIFT) tensing rules. Since the forms all have lax vowels at the time of the general LAXING rules, such as CLUSTER LAXING and TRI-SYLLABIC LAXING, this analysis avoids some of the problems of SPE mentioned earlier.

While the Griggs phonology is promising, it is my contention that it does not go far enough. Where Griggs recognized underlying diphthongs, I propose to eliminate the glides [y] and [w] entirely from the inventory of underlying phonological segments in English, deriving the phonetic realizations exhibited in (6) above from underlying /prei feu laud boi grou/ through the addition of appropriate and quite plausible rules of GLIDING. In other words, my analysis will simplify the inventory of English phonology, reducing by two the total number of phonemes.

The importance of such an achievement must not be underestimated. The phonemes of a language represent the minimal number of phonologically-distinct sound units necessary (a) to represent the morphemes of the language and (b) to predict the phonetic actualizations of the formatives. In this definition, minimal is the key term, for any phonology that uses more units than are needed is less highly valued as
a theory of language than one which achieves the same result with fewer underlying segments. Thus, while English has both [p] and [pʰ] phones, as in spin and pin, all linguists agree that these are merely positional variants (i.e., allophones) of the same phoneme. My dissertation demonstrates that the same holds true for English [i] and [y] and for English [u] and [w] as well. Modern English, like proto-Indo-European (Edgerton, 1946:13-14) has only a single phoneme corresponding to each set, for both [y i] derive from /i/ and [u w] derive from /u/.

The relative ease with which the purpose of this dissertation and the explanation of its importance may be stated belies the extent and difficulty of the task. If, as I contend, English has no underlying /y/ or /w/, it is necessary to provide an alternate coherent account of all observed occurrences of these two phones in the pronunciation of English. Such an account requires adding new rules to the phonology as well as revising and rearranging existing rules. However, no addition or revision must be allowed to distort or impair any of the other rules of phonology, for a generative phonology grammar is like a spider web or a mobile sculpture: touching one small part will ultimately have effects on many other parts. Therefore, although I have dealt with a relatively small part of English phonology, any change which I made was not allowed to alter the effectiveness of what is essentially a valid grammar of English phonology. Thus, all
parts of that grammar were kept in mind as I completed this revision. While certain portions of the phonology which are largely irrelevant to my purposes were slighted in my account, the fact remains that in carrying out my revision, I have written a generative phonology of the English language.

In order to align the present analysis with that of Chomsky and Halle, the target dialect of this dissertation is that adopted in SPE (ix), that is, General American English as described by Kenyon and Knott (1944). The ten tense vocalic nuclei displayed in (4) above provide for General American English a three-way distinction among the diphthongal sequences [æh], [əh], and [œw] as in rot, wrought, and wrote, whereas many dialects have only a two-way distinction.

With a few exceptions in the recounting of linguistic analyses in which the transcriptional practice of the individual linguist has been maintained, the notational system of the present work adheres to that system implicit in SPE; thus, for instance, here as in SPE, [h] is used with systematic ambiguity to refer to the voiceless laryngeal glide in syllable-initial position and to the centering oral glide, i.e. [a], in post vocalic position. Conventions of linguistic formalism are employed throughout. However, perhaps a special note regarding the use of brackets and virgules should be made: brackets serve as a general symbol for any phonological segment at any level except for that of phonological lexical representations, which is indicated by the use of virgules.
This dissertation is organized in five parts. Following this introductory chapter, Chapter II provides the theoretical linguistic framework of transformational generative analysis of English into which the grammar developed here must be integrated. Chapter III considers the problems which are inherent in SPE glide analysis and develops a new grammar of English which recognizes no underlying glides /y w/. The rules of this new grammar, integrated into a complete phonological grammar of English, are summarized in Chapter IV. Chapter V contains comment on some unsolved problems related to the present undertaking.
CHAPTER II

GLIDES IN AMERICAN ENGLISH

The present work develops a grammar of English phonology which contains no occurrence of the glides [y] and [w] in phonological lexical representations. This chapter provides a technical description of the observed (phonetic) distribution, nature, and function of these glides as well as a survey of pertinent works concerning transformational generative theory and the treatment of glides within that theory.

The Observed Distribution of Glides in English

Phonetically [y] and [w] are the non-syllabic counterparts of the vowels [i] and [u] respectively; that is, [y] is a non-syllabic, high, front, unrounded, lax phone, and [w] is a non-syllabic, high, back, rounded, lax phone. [y] and [w] must occur contiguously with a vowel and may not occur contiguously with each other (Griggs, 1978a); English, therefore, has [biyt], [bėyt], [byūwtiy], [būwtiy], [bōwt], [win], [wēyn], [wāyn], [yam], etc. but has no *[byyt], *[bywt], *[bwyt], or *[wyūw].

In English, [y] and [w] occur in both pre- and post-vocalic positions. In post-vocalic positions, i.e., functioning as the glide element of a diphthong, [y] follows the vowels [i ē æ 3] while [w] follows the vowels [u ū a]. In
pre-vocalic positions, both \([y]\) and \([w]\) pattern freely in initial position before most vowels. However, in the context \#(C)C\_V, both \([y]\) and \([w]\) are subject to a number of constraints on occurrence. In this context, for instance, \([y]\) occurs only before \([\text{\^{u}}w]\) or reduced forms of this vowel (i.e., before \([u]\) or \([\text{\^{e}}]\)). In this context, \([y]\) of \([\text{\^{y}}uw]\) may follow the labial and velar phones (as in beauty, pew, few, view, cue, cute), but it may not follow the coronal phones \([\delta \, \text{s} \, \text{z} \, \text{c} \, \text{j}]\). Following other coronal consonants, \([\text{\^{y}}uw]\) varies with \([\text{\^{u}}w]\) depending on dialect and/or register (thus both \([n\text{\^{u}}w]\) and \([n\text{\^{y}}uw]\), \([l\text{\^{u}}wt]\) and \([l\text{\^{y}}uw]\), \([t\text{\^{u}}wn]\) and \([t\text{\^{y}}wn]\) are possible). In the context \#(C)C\_V, \([w]\) usually precedes only non-round vowels (as in twin, twice, twain as opposed to two; some exceptions such as swore, swoop, and quote do occur). The tautosyllabic consonant immediately preceding \([w]\) may not be any of the labials \([p \, b \, f \, v \, m]\), nor the coronals \([\delta \, z \, n \, l]\),

---

1At least this is true in the dialect being described. In fact, Kenyon (1935:210) points out that instead of the triphthong \([\text{\^{y}}uw]\), many Americans, in non-initial position, have what I would transcribe as \([i\text{\^{w}}]\), and Kenyon and Knott make clear in the preface to their dictionary (1948: that their use of the symbol \([\text{\^{u}}]\) always refers to this falling diphthong. For speakers who regularly have \([i\text{\^{w}}]\) in cute words, it is possible to distinguish, at least phonetically, between the two members of the following sets: choose/chews, brood/brewed. Obviously the rules in the grammar of dialects which maintain this distinction are different from those contained in SPE; however, since the target dialect of this dissertation treats the above sets as homophones, no attempt is made to formulate rules which will generate both forms of sets which do make a distinction.
nor any of the palatals [č ŋ š ş r], nor the velar nasal [ŋ] (Griggs, 1978a). When speakers of English say pueblo, bueno, bwana, foie gras, voila, or moi with initial [pw], [bw], [fw], [vw], and [mw], they are not producing counter-examples to the constraint on [w]; they are employing the phonological co-occurrence potential appropriate to Spanish, Swahili, or French. Alternately, when the French words voile or voyeur are pronounced by English speakers without the initial [vw] segments appropriate to French, the morphemes have undergone an alteration so that English phonological constraints on the contiguity of [vw] have been applied. A similar alteration has occurred when pueblo is pronounced [puweblow] or [pyuweblow].

Transformational Generative Theory

Chomsky and Halle in The Sound Pattern of English (1968) produced the first extensive grammar of English phonology based on the concept that abstract or underlying phonological forms (phonemes) are altered by generalized processes, i.e., phonological rules, into phonetic representations. Although some of the concepts on which Chomsky and Halle built their grammar originated with other linguists perhaps as early as 1932, the innovativeness of this transformational generative approach to language analysis cannot be denied. In his review of SPE, Hoard (1971/75:56) compares the contribution of Chomsky and Halle to phonological theory to the accomplishment of Strindberg in drama. Hoard cites Pär Lagerkvist's
comment that, unlike Ibsen, who "can be circumvented, like a
milepost with a Roman numeral on it," Strindberg's expression-
ist theatre stands "in the middle of the road and one is
allowed to pass only after one first understands him [Strindberg]
and what he actually signifies." Hoard assigns a similar
position to SPE: linguists must understand SPE and what it
signifies before they can proceed to solve the observed prob-
lems in the grammar proposed there.

Chomsky (1960) considered the aim of linguistic theory
should "exhibit the built-in data organizing capacities of
the child which lead him to develop the specific linguistic
competence characterized in a fully explicit grammar." Such
a "fully explicit grammar" contains both a syntactic and a
phonological component. According to Chomsky and Halle
(1968:60), the phonological component receives from the
syntactic component

a string with a surface structure that is
represented by labeled bracketing. The sequence
of phonological rules [which are linearly ordered]
is first applied to all innermost constituents of
this string. Innermost brackets are then deleted,
and the sequence applies to the new innermost
brackets. This cyclical application is repeated
until the maximal domain of phonological processes
is reached. (The maximal domain is the "phonologi-
cal phrase," which we assume to be marked in the sur-
face structure).

The product of the application of phonological rules to the
phonological representation is a phonetic representation.
Thus, the grammar (or set of phonological rules) provides a
systematic means of going from deep to surface structure and
in so doing captures the relationships between similar processes which the native speaker intuits. The choice among competing grammars which are equivalent in terms of their descriptive adequacy is typically made by reference to the criterion of simplicity. Hyman (1975:101-2) states that

"simplicity is a technical term defined by the theory, and not a loosely conceptualized intuitive notion. Originally Chomsky (1965) stated that "simplicity correlates with 'maximal degree of generalization.'"

Hyman (102) also observes that "every claim about the nature of simplicity is necessarily a claim about the nature of one's innate language faculty."

The syntactic string of labeled brackets which the phonological component receives is composed of a sequence of phonological segments. At this point in the derivation, these phonological matrices are minimally specified. Chomsky and Halle (166) declare that

phonological matrices typically consist of archi-segments. Thus, an important difference between phonological and phonetic matrices is that the latter are fully specified while the former are not. In fact, one major function of the phonological rules is to extend phonological matrices to full phonetic matrices.

Matrices become fully specified through the addition or alteration of the distinctive features through generalized phonological processes. These features, expressed binarily, represent both acoustic and articulatory properties of the phones.
The phonological rules which transform the received syntactic string into its phonetic representation must do so with the greatest degree of simplicity possible. Chomsky and Halle (60) comment upon the precision with which such rules must operate, indicating in fact the precision with which such rules must be formulated if the linguist is to approach his domain with the same degree of care which any scientist must employ:

The rules of the grammar operate in a mechanical fashion; one may think of them as instructions that might be given to a mindless robot, incapable of exercising any judgment or imagination in their application. Any ambiguity or inexplicitness in the statement of rules must in principle be eliminated, since the receiver of the instructions is assumed to be incapable of using intelligence to fill in gaps or to correct errors. To the extent that the rules do not meet this standard of explicitness and precision, they fail to express linguistic fact . . .

The concepts of distinctive feature analysis, of the bi-polarity or binality of these features as they express distinctive oppositions, and of an abstract or phonological level of representation underlying the observed or phonetic level of representation, a level in which similarities or oppositions of phonemes may be described by distinctive features with binary values—all concepts central to SPE analysis—are not original with Chomsky and Halle. Trubetzkoy (1939/69:36), apparently following Jakobson (1932), defined the phoneme as the "sum of the phonologically relevant properties of sound." Trubetzkoy further observed that
the phonemic inventory of a language is actually only a corollary of the system of distinctive oppositions. It should always be remembered that in phonology the major role is played, not by phonemes, but by the distinctive opposition. Each phoneme has a definite phonemic content only because the system of distinctive oppositions shows a definite order or structure (67-8).

To the idea expressed by Trubetzkoy that what is significant for phonological analysis is distinctive opposition, Jakobson, Fant, and Halle (1952; 1956) added or refined a concept of bi-polarity or binary values to express such opposition. Jakobson et al. further observed that relationships or oppositions of phonetic segments could be systematized by an analysis of phonological segments underlying the level of phonetic representation. Hyman (1975:39) comments that Jakobson's "feature analysis is possible only as a result of Jakobson's focus on underlying sound contrasts rather than on surface phonetic contrasts." An example of this capacity to systematize is the classification of phonemes employing the features Consonantal and Vocalic (Jakobson, Fant, and Halle, 1952; Jakobson and Halle, 1956). This analysis allows true consonants to be described as $[+\text{cons}]$, vowels to be specified as $[-\text{voc}]$, the liquids [l r] to be indicated by $[+\text{cons}]$, and the glides to be described by $[-\text{cons}]$. Vowels are distinguished from each other by the feature [back], which allows two degrees of frontness/backness, and the features [high] and [low], which permit three vowel heights to be indicated: $[+\text{high}]$, $[-\text{high}]$, and $[-\text{low}].$
Chomsky and Halle in SPE modified the concept of an underlying phonological level in which phonemic opposition is expressed through distinctive features with binary values by positing a set of rules which transform the underlying segments into phonetic representations. Hyman (1975:42) observes that while Jakobson's emphasis was in capturing all the possible phonological contrasts of languages by means of his features, Chomsky and Halle (1968) explicitly distinguish two functions of these features. On the one hand, the distinctive features are designed, like Jakobson's features, to capture the phonological contrasts of languages. On the other hand, they are designed to describe the phonetic content of segments derived by phonological rules, as well as underlying segments . . . .

Thus, while several of the analytic concepts which are central to SPE theory are not original to its authors, the fact remains that the transformational generative grammar presented there has provided a unique manner for analyzing English phonology.

Transformational Generative Analysis of Glides

The following section recounts the SPE analysis of the glides [y] and [w] and the various rules such as DIPHTHONGIZATION which are associated with that treatment. Commentaries on the SPE analysis and the problems attendant upon it as well as alternate analyses by other linguists are also included.
Chomsky and Halle

Central to any examination of glides in English phonology is an analysis of the treatment of vowels in English. As previously noted, Jakobson, Fant, and Halle (1952) distinguish two degrees of frontness/backness and three degrees of vowel height. These features, [back], [high], and [low], have been adopted by the transformational generativists. Since there are two levels of representation, Chomsky and Halle posit two sets of vocalic alternations or oppositions: underlying and observed. The inventory of underlying vowels contains eight tense and six lax vowels. (1) illustrates the underlying vowels in a grid marked for the features BACK, HIGH, and LOW (tense vowels are indicated by a macron over the vowel symbol).

(1)

\[
\begin{array}{cccc}
\text{HIGH}^+ & - & \text{BACK} & + \\
\hline
T & i & u & \text{\textbar}\text{\textbar} \\
\bar{e} & e & o & \bar{e} \\
\text{\textbar}e (\bar{e}) & \bar{a} & \bar{a} & \bar{o} \\
\hline
\end{array}
\]

(2) displays the observed (phonetic) vowels with pronunciation key words in which the vowel nuclei appear. One may note that all of the tense vowels are expressed as diphthongs.
Chomsky and Halle (52) observe that "there are no post-vocalic glides in underlying forms." The glide elements [y] and [w] are inserted following tense vowels by the DIPHTHONGIZATION RULE (3).

\[
\begin{array}{ccc}
\text{iy (beat)} & \text{yw (butte)} & \text{uw (boot)} \\
\text{i (bit)} & \text{u (bull)} & \\
\text{ey (bait)} & \text{ow (boat)} & \\
e (bet) & \text{\Lambda (but)} & \\
\text{ah (bot)} & \text{5h (bought)} & \\
\text{aw (bout)} & \text{ay (bite)} & \text{5y (boy)} \\
\text{e (bat)} & & \\
\end{array}
\]

The DIPHTHONGIZATION RULE inserts a glide which agrees with the tense vowel in backness and whose features of backness and roundness agree. Thus [y] is inserted following tense front vowels, and [w] is inserted following tense back vowels. The feature [β rule 32] signifies that the glide segment which is inserted will have copied into its matrix the plus or minus value of rule 32 which exists in the vowel matrix. (Rule 32, GLIDE VOCALIZATION, changes the value of the feature [voc] from minus to plus following [u], [\Lambda], and [a]; that is, [w] becomes [u] in this environment if the vowel matrix contains [+ rule 32]. The glide [y] does not undergo this transformation.) The DIPHTHONGIZATION RULE
captures the generalization that \([y]\) and \([w]\) predictably appear following tense vowels; as a result, the inventory of underlying phonemes does not have to include both tense vowels and diphthongs, and a greater degree of simplicity is achieved than would be possible were both tense vowels and diphthongs included in the phonemic inventory. Problems which result from the SPE analysis of DIPHTHONGIZATION, GLIDE VOCALIZATION, and VOWEL SHIFT will be discussed in detail in a subsequent section of this study.

The DIPHTHONGIZATION rule does not explain the \([y]\) glide element in pre-vocalic position in \([y\ddot{u}w]\), however. Chomsky and Halle (192ff) wish to introduce this \([y]\) by transformational rule in order to avoid underlying configurations such as C[y]VC as in cute or accuse, which would necessitate their giving up "otherwise valid generalizations concerning consonant-glade-vowel sequences in underlying representations." These generalizations concern the co-occurrence constraints on \([w]\) in the configuration CGVC. SPE (192-3) summarizes these generalizations as follows.

\[(4)\]  
(a) \(G + w / C\ldots V\)  
(b) \(C + [-nasal]/\ldots G\)  
(c) \([+ant][+cor]/\ldots G\)  
(d) \(C \rightarrow [-ant]/\ldots G\)  
(e) \([+voc] \rightarrow [-back] /[ -cont ] G_{\ldots} \)  
\([-cons] \rightarrow [-low] \)

These generalizations are valid if and only if \(G = [w]\). Case (a) overtly specifies \([w]\); the observation is intended to
describe the treatment of rounded consonants; however, forms such as [kyʊwt] which have the same CGV pattern with [y] do occur. Case (b) shows that a nasal segment may not immediately precede the glide. This constraint applies to [w], for forms such as *mwist or *nwell do not occur; however, the same constraint does not apply to [y] (cf. [myʊwz] and nyʊwz). Case (c) shows the constraint on the co-occurrence of the glide with the labials [p b f v m]. [w] may not occur in this environment, but [y] frequently follows labials as in pew, beauty, few, view, and muse. Case (d) permits the glide after [sk] but not after [st]; thus while squaw, squash, and squint are well-formed, *stwint or *stwall is not. [y], however, can occur after [st] as in stew. Finally, Case (e) excludes phonological forms such as /kwʊt/, /kwʊt/, which would eventuate as phonetic *[kwʊwt], *[kwəwt] (or *[kwɑʊt]), respectively, by the Diphthongization and Vowel Shift Rules, while permitting phonological /kwɪr/, /kwɪt/, which became [kwɪr] (queer), [kwɪt] (quite), respectively. But it would be contradicted by cube, accuse, and numerous other forms (193).

Consideration of the validity of these generalizations if G = [w] only led Chomsky and Halle to propose that [yʊw] comes from a monophthongal source to which [y] is inserted in pre-vocalic position by phonological rules. Their full argument will not be rehearsed here. Their solution, however, may be stated quite simply. For the underlying vocalic segment, they propose [u]. [u] becomes [-rounded], i.e., [ɨ] in certain contexts. A phonological rule,
(5) \( \phi \rightarrow y \) 
\[ +\text{tense} \]
\[ -\text{round} \]
\[ +\text{high} \]
\[ +\text{back} \]
\[ V \]

inserts \( [y] \) before \( [\ddagger] \). DIPHTHONGIZATION adds \( [w] \) following \( [\ddagger] \). The sequence \( [yw] \) is exempted from VOWEL SHIFT because \( [\ddagger] \) does not agree in roundness and backness. The second context of the ROUNding ADJUSTMENT rule (SPE:244)

(6) \( [+\text{round}] \) 
\[ -\text{around} \]
\[ -\text{low} \]
\[ -\text{round} \]
\[ +\text{tense} \]

switches the roundness of \( [\ddagger] \), producing the desired output \( [yw] \).

Since \( [y] \) appears only before \( [\ddagger w] \) in the context (c)C\_V (according to SPE analysis), Chomsky and Halle are able to describe its predictable occurrence with phonological rules and are thus also able to retain their generalizations about consonant-glide-vowel sequences, observations which apply only to the glide \( [w] \) in that context. In that context, \( [w] \) is also introduced by rule (SPE:239) following rounded consonants.

(7) \( \phi \rightarrow w \) 
\[ +\text{round} \]
\[ -\text{voc} \]
\[ +\text{cons} \]

The co-occurrence constraints shown in (4) above need not be specified in this rule (7) since forms which violate the constraints do not occur.
Finally, Chomsky and Halle recognize both underlying /y/ and /w/ in word-initial position. Although no word-final /w/ exists, Chomsky and Halle posit word-final /y/ for forms such as aristocracy, city, democracy, and policy. For Chomsky and Halle, then, /y/ has the distribution.

\[(8) \# V \]
\[C \# \]

while underlying /w/ has the rather unusual distribution of

\[(9) \# V \]

These occurrences of /y/ and /w/ will be treated in detail in a subsequent section of this paper.

Thus, the SPE treatment of post-vocalic glides in English is straightforward. Glides in post-vocalic position—i.e., as the glide element of diphthongs—are intimately related to the SPE analysis of vowels. Because of its crucial importance to the study of glides and since it may serve as a kind of summary for the SPE position, the SPE derivation of phonetic realizations of stressed and lax vowels is illustrated in Figures 1 and 2 respectively (see pp. 25-26).

Derivation of the eight underlying tense vowels is illustrated in Figure 1. The five pertinent rules cited are rules 31-35 in Chapter V of SPE. The table clearly reveals the effects of DIPHTHONGIZATION ((3) above). The two bifurcations, which involve underlying /ə/ and /ʊ/, are effected
/ɪ ɛ æ ɔ æ ʊ ø ɹ / Phonological

ɪɨ ɛɨ æɨ ɔɨ æw ʊw øw ɹw Diphthongization

ʊu ʊu Glide vocalization

əʊ əʊ ɹw ʊw øw Vowel shift

əw ɹə Backness adjustment

əɨ ɹɨ ɹə ɹə ɹə ɹɨ ɹə ɹə Phonetic

bite best bait boy father laud Austin bout boot boot boat Examples

Fig. 1--SPE analysis of underlying tense vowels
/i e a o u /

\[ \text{UNROUNDING} \]

\[ [w] \text{ INSERTION} \]

\[ \text{TENSING} \]

\[ [y] \text{ INSERTION} \]

\[ \text{WEDGE LOWERING} \]

\[ \text{DIPHTHONGIZATION} \]

\[ \text{GLIDE VOCALIZATION} \]

\[ \text{VOICE SHIFIT} \]

\[ \text{ROUNDNESS ADJUSTMENT} \]

\[ \text{BACKNESS ADJUSTMENT} \]

\[ \text{TENSING} \]

\[ \text{Phonetic} \]

\[ \text{Examples} \]

Fig. 2--SPE analysis of underlying lax vowels
by readjustment rules which exempt certain vowels from the effects of certain rules in specified environments. Here, the crucial environments are the number of syllables. In the two bifurcations, the left fork is restricted to poly-syllabic morphemes; the right fork, to monosyllabic forms.

In contrast to the relative simplicity of the SPE analysis of tense vowels, lax vowels, especially back ones, are much more complex in their derivations (see Figure 2). The complexity of these derivations, especially those for words like cute, old, and long, has not escaped criticism, criticism which I feel is quite justified. Some of this criticism is reviewed here; more is presented in Chapter III.

Wang

Not all linguists readily accept Chomsky and Halle's analysis of complex vowel nuclei in English, due in part to dissatisfaction with the DIPHTHONGIZATION and VOWEL SHIFT rules. Wang (1968), for instance, questions the two-phase nature of SPE's VOWEL SHIFT rule as well as its two tongue-region, three tongue-height vowel analysis. Wang (707-8) suggests that the SPE VOWEL SHIFT rule reflects accurately the diachronic process; however, he comments that synchronic evidence supports a simplified, one-phase version of the rule. Wang's concern regarding vowel height, a concern shared by other critics of SPE, is based on his consideration of languages other than English which do demonstrate four or more vowel heights. Consequently, Wang proposes to use the
features HIGH and MID to specify vowel height and the features PALATAL and VELAR to specify tongue position. (10) presents Wang's suggestion for the phonological features of vowels (701).

<table>
<thead>
<tr>
<th>(10)</th>
<th>+Palatal</th>
<th>-Palatal</th>
<th>-Palatal</th>
<th>+Velar</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>-Velar</td>
<td>-Velar</td>
<td>+Velar</td>
<td></td>
</tr>
<tr>
<td>i</td>
<td>+, u</td>
<td>u</td>
<td>+High</td>
<td>-Mid</td>
</tr>
<tr>
<td>e</td>
<td>e</td>
<td>o</td>
<td>+High</td>
<td>+Mid</td>
</tr>
<tr>
<td>æ</td>
<td>æ</td>
<td>o</td>
<td>-High</td>
<td>+Mid</td>
</tr>
<tr>
<td>æ, a</td>
<td>æ</td>
<td>a</td>
<td>-High</td>
<td>-Mid</td>
</tr>
</tbody>
</table>

Wang (701) states a redundancy convention for English vowels (11)

(11) (a) [+palatal] \rightarrow [-velar]
(b) [+velar] \rightarrow [-palatal]

in order to prevent any segment being marked as [+palatal, +velar] since such a tongue position is physiologically impossible. His marking convention for English vowels (12)

(12) (a) [upalatal] \rightarrow [upalatal]
(b) [ulabial] \rightarrow [alabial]

is intended
to formalize the observations that central vowels [-palatal, -velar] are not favored in languages and that high back vowels are usually labialized, whereas high front vowels (in the sense of high as shown in (10) above) are usually not.

Wang's (707) proposed VOWEL SHIFT rule, given here as (13), produces the desired alternations of vowels in one step rather than two.

\[
\begin{align*}
\gamma_{\text{velar}} & \rightarrow \gamma_{\text{high}} \\
\gamma_{\text{labial}} & \rightarrow \gamma_{\text{mid}} \\
V & \rightarrow \gamma_{\text{mid}}
\end{align*}
\]

A redundancy rule (14) (Wang:702) combines with Wang's VOWEL SHIFT rule in order to derive /e/ from /a/ rather than the /ɛ/ which vowel shift alone would produce.

\[
[+\text{mid}] \rightarrow [+\text{high}]
\]

Wang's four-height, three tongue-position vowel grid is typical of the vowel analysis which many SPE critics posit. Wang's claim of one-step simplicity is perhaps offset by his observations regarding those vowels which are marked [+mid]. In his developmental discussion for redundancy rule (14), Wang (702) comments,

Morphophonemically, however, and perhaps also phonemically, the mid vowels may be specified either [+high] or [-high], depending on their function in the phonological system; or they may be left unspecified. In English the mid vowels function like high vowels in that /e/ palatalizes and sibilates certain preceding consonants much as /i/ does; cf. induce/ induction; oblige/obligation. (The so-called "silent e" can be justified on morphophonemic grounds.) Therefore the mid vowels in English should be represented as [+high] . . . .
One wonders why Wang and other linguists insist upon a four vowel-height analysis for English when one rank is redundantly empty.

Wang (707-8) cites Halle's (1962) observation that historical phonological changes result ultimately in a simplification of the grammar. Thus he claims that his proposed VOWEL SHIFT rule (12) reflects the simplification of the diachronically accurate SPE two-phase VOWEL SHIFT rule. His rule, he says, may represent a telescoping of an historically correct sequence of changes.

Imai

Another outspoken critic of the SPE analysis of English vowels is K. Imai. His 1971 article, while called a review of the whole book, is actually a set of arguments supporting Imai's own analysis of English vowels. Imai's position includes a rejection of the two-by-three vowel grid of SPE, a complete reformulation of the VOWEL SHIFT rule, and a quite different inventory of underlying vocalic segments. Because he argues so strongly against certain aspects of SPE which I myself reject in the next chapter, some attention to his analysis is in order here.

Like Wang discussed above and Hoard (1975), Imai insists on a three-by-four vowel grid, utilizing the features [high] and [mid] to designate the four height positions and the features [back] and [central] to designate vowel regions, [+central] vowels being redundantly [+back]. His inventory
of underlying vowels (416) is given in (15). Observe that,

\[
\begin{array}{ccc}
- & \text{Back} & + & \text{Back} \\
\text{+ High} & \text{I} \ i & \text{Œ} \ œ & \text{ū} \ u & - & \text{Mid} \\
\text{- High} & \text{e} \ e & \text{ā} \ ā & - & \text{Mid} \\
\text{- Central} & - & \text{Central} & - & \text{Central}
\end{array}
\]

while rejecting the three-height vowel grid of SPE on universal grounds, Imai makes no use of all four heights for English, excluding the possibility both phonologically and phonetically of [+mid-high] vowels by adopting (417) an "anywhere" rule (a marking convention acting as a rule of linkage, in the sense of SPE Chapter IX) with this effect [+mid] \rightarrow [+high].

Citing Wang as support for his decision to adopt the three-region vowel grid, with front, central, and back vowels, Imai finds good use for this distinction among high vowels, but he silently imposes this unnatural distinction on low vowels as well. Yet, neither he nor any other linguist has ever described a single language anywhere that uses a three region contrast in low vowels for linguistic purposes.

Perhaps the most startling gap in Imai's inventory of underlying vowels of English is the absence of forms containing [+back +high +mid] vowels, i.e., /œ o/. Imai denies any need
for underlying lax /o/, posited in SPE for honey and money, and determines to derive such forms as noon, fool, and boot from underlying /ʊ/. Unfortunately, he, like SPE, would use this same underlying segment as the source for the [ɔw] in fowl and bout. He decides to distinguish those /ʊ/ which undergo /ʊ/ → [ɔ]/w by lexical marking. In other words, the well-known and time-honored contrast between the items in the sets who-how, boot-bout, pooch-pouch, sooth-south, moose-mouse, roost-roust, noon-noun, and fool-foul Imai would make a function of lexical marking, exempting the first item in each case from the effects of /ʊ/ → [ɔ] shifting. He offers absolutely no explanation for such observed alternations as fool-folly, shoot-shot, money-monetary, and lose-lost.

Owing perhaps to the brevity of his article, Imai offers no explicit explanation of how /ʌ/ are to be manifested phonetically except to note that tense /ʌ/ underlies the vowel in bird. Otherwise his system is illustrated in Figure 3, where his notation has been converted to the one used in this dissertation. A comparison of Figure 3 with the SPE treatment (Figures 1 and 2) reveals certain similarities. Imai’s treatment of underlying /ɨ ɘ ə ɘ i e/ is the same as that of SPE. Imai’s /æ/ → [ə] is like SPE, but Imai, who derives [əh] of par, bar, car(t) from /ə/, can give no explanation for the obvious morphological connections with parity, barrier, and carry. The derivation of [ʌ] from /ʌ/ exemplified in but is shared by underlying vowels
Fig. 3--The Imai system
which have been laxed in induction and *profundity*. Observe again Imai's decision to lump the *boot* and *bout* words together underlyingly, distinguishing them only by means of lexical rule-feature marking. This ploy makes it virtually impossible to capture the lexical redundancy exhibited by *bout* words, namely that phonetic /ɔw/ occurs freely before word boundary and coronal consonants but not before non-coronal consonants. That is, while English permits *poop*, *boob*, *proof*, *move*, *doom*, and *spook*, there are no corresponding *[-awp, -awb, -awf, -awv, -awm, -awk]*. Finally, observe that Imai adopts a quite sensible and natural analysis for [ɔy], deriving it from an underlying lax diphthong /ɔy/, a strategy that suggests the approach that Griggs has generalized and which, in Chapter III, I refine.

Special attention must be given to Imai's analysis of cute words, those which I describe as having phonetic [yəw]. In his decision to describe this triphthong as [yəw], where a high rounded central tense vowel is followed by its homorganic glide, Imai relies heavily on the description of this sound in *American English* by Kenyon (1940:210-16). Kenyon, who seems to favor a pronunciation that would make *duty* and *booty* non-rhymes, is talking about phonetic manifestations, and he never makes the claim that, at least at some point in their derivation, the two words do not qualify as rhymes. In fact, Kenyon himself (216) cites dialects in New England in which *due* and *do* words have become so confused that the latter
are sometimes pronounced like the former, a phenomenon which would be quite unlikely were these two nuclei as thoroughly contrastive as Imai's analysis claims.

As for the rules Imai proposes to account for the observed alternations, the most interesting are a version of [y] INSERTION, which inserts a [y] before any high non-mid central vowel, lax or tense, and his rule of DIPHTHONGIZATION, which inserts, following any tense vowel, its homoorganic glide counterpart. (16) presents what I take to be Imai's analysis, although it must be understood that, since he does not include a summary of rules, it is necessary at times to resort to guesswork in a matter of rule ordering.

(16)

<table>
<thead>
<tr>
<th>uvula</th>
<th>ritual</th>
<th>induce</th>
<th>induction</th>
</tr>
</thead>
<tbody>
<tr>
<td>uvula</td>
<td>ritual</td>
<td>indēs</td>
<td>indēktiVn / Underlying</td>
</tr>
<tr>
<td>ritual</td>
<td>ritual</td>
<td>indēktiVn</td>
<td>LAXING</td>
</tr>
<tr>
<td></td>
<td></td>
<td>indēktiVn</td>
<td>[u] LOWERING</td>
</tr>
<tr>
<td>yuvylə</td>
<td>rityʊəl</td>
<td>indyɨəs</td>
<td>[y] INSERTION</td>
</tr>
<tr>
<td>rityʊəl</td>
<td></td>
<td></td>
<td>TENSING</td>
</tr>
<tr>
<td>yuvylə</td>
<td>rityʊəl</td>
<td>indyɨəs</td>
<td>DIPHTHONGIZATION</td>
</tr>
<tr>
<td>yuvylə</td>
<td>rityʊəl</td>
<td>indyɨəs</td>
<td>indākshan</td>
</tr>
</tbody>
</table>

The forms derived in (16) are my examples, not Imai's. They have been selected so as to reveal the strengths and weaknesses in his system. Observe first of all the treatment of induce-induction. Although Imai rejects, in a tone that can only be
called petulant outrage (420-l), the use in SPE of final /e/ or /ɛ/ to account for the tensing (and unrounding) of the lax /u/ in the -duce forms, he offers no other method of relating -duce/duction, nor of explaining such alternations as allege-allegation and Greece-Greek. Thus I assume that the many -duce/-duction forms must be handled suppletively. I do, however, make the vowel in induction tense in order to exemplify how laxing works.

CLUSTER LAXING works nicely for -duce/duction. TRI-SYLLABIC LAXING, however, while achieving the necessary laxing of the tonic vowel in ritual (cf. rite), fails for some unknown reason to affect the tonic vowel of uvula at all. No explanation is offered. (The process of converting [u] to [ʌ] described here as [y] LOWERING (Rule 27 on 429) omits an intermediate step, i.e., the unrounding of [ɛ] to [ʌ], which Imai takes care of with a quite elaborate roundness adjustment redundancy rule (28, 429).) The rule of [y] INSERTION (Rule 13, 422) applies to both lax and tense high non-mid central vowels. However, it is just as opaque as the SPE rule (Rule 29, 243) since nothing in its formal statement shows whether it is an assimilative or dissimilative process. Finally, observe how the rule of PRE-VOCALIC TENSING correctly tenses the lax [u] in ritual. (Similarly, the rule of FINAL VOWEL TENSING would presumably correctly tense the final vowel of value.) Then, DIPHTHONGIZATION adds the glide [ʏ] following any tense case of that vowel, but not to the lax case in the middle vowel of
uvula. Other rules, including VOWEL REDUCTION, then operate to yield the phonetic forms displayed.

The greatest contribution to the study of English phonology of Imai's review is the devastating attack on the "gimmicky" rules of SPE which unround various instances of underlying lax /u/ and /o/ so as to exempt them from the effects of later rules of vowel shift. I heartily agree with Imai in denigrating this approach. The greatest weakness of his analysis is its very sketchiness, plus the fact that he provides no summary of ordered rules. Without the latter, it is really impossible to determine whether his proposals really work.

Krohn

Krohn (1972) also objects to the SPE vowel analysis and VOWEL SHIFT rule. Krohn (218) states that it is possible within the framework of generative phonology to account for vowel alternation in Modern English without positing highly abstract underlying representations that resemble the corresponding representations in Middle English. There is little reason to believe that the high degree of abstractness entailed in the Middle English hypothesis is necessary in an analysis of Modern English phonology. Although this [Krohn's] study has not provided a definite answer to the question of how abstract underlying representations are, it does suggest strongly that they are somewhat closer to the surface, i.e., less abstract, than has generally been assumed by generative linguists.

Krohn (204) also suggests an analysis of underlying vowels which contains four vowel heights. The three
diphthongal segments /æ/, /o/, and /a/ are specified as
because in "true" diphthongs "the tongue moves from
a lower to higher position" (203). In a note, Krohn recites
the SPE (305, 408) constraint against marking a segment
simultaneously [+high, +low], because the tongue cannot be
in both positions at once. Krohn (221) argues that segments
in the phonological level need not necessarily yield to the
physical constraints imposed on segments in the phonetic
level. He points out that Chomsky and Halle suggest a
similar treatment in their discussion of prenasalized con-
sonants (SPE:317) in which they propose to allow "the features
which correlate with the different positions of the velum to
be contained within the limits of a single underlying segment"
(222).

In order to achieve the sequencing of the underlying
single-segment diphthongs into contiguous segments which must
exist at the phonetic level, Krohn (223) proposes the
following LOW-HIGH SEQUENCING rule. The rule represents "two

(18) \[
\begin{array}{ccc}
\text{Vowel} & \text{Vowel} & \text{Satellite} \\
+\text{low} & +\text{low} & +\text{high} \\
+\text{high} & +\text{round} & +\text{front} \\
\text{afront} & +\text{round} & <\text{round}\ \\
\end{array}
\]

disjunctively ordered rules, the first with the features in brackets, the second without them" (223). Krohn's LOW-HIGH SEQUENCING rule is applied to his three \([+\text{low}] +\text{high}\) diphthongs in (19) below (additional features from his underlying vowel chart are shown in parentheses).

(19) \(/o^1/\)

\[
\begin{array}{ccc}
\text{Vowel} & \text{Vowel} & \text{Satellite} \\
+\text{low} & +\text{low} & +\text{high} \\
+\text{high} & +\text{round} & -\text{round} \\
\text{afront} & (-\text{front}) & +\text{front} \\
\end{array}
\]

\(/a^u/\)

\[
\begin{array}{ccc}
\text{Vowel} & \text{Vowel} & \text{Satellite} \\
+\text{low} & +\text{low} & +\text{high} \\
+\text{high} & (-\text{round}) & +\text{front} \\
-\text{front} & (-\text{front}) & (-\text{round}) \\
-\text{round} & & \\
\end{array}
\]

\(/a^I/\)

\[
\begin{array}{ccc}
\text{Vowel} & \text{Vowel} & \text{Satellite} \\
+\text{low} & +\text{low} & +\text{high} \\
+\text{high} & (-\text{front}) & +\text{front} \\
\text{afront} & (-\text{round}) & (-\text{round}) \\
\end{array}
\]

This rule should, in effect, operate in a manner similar to the SPE DIPHTHONGIZATION rule since it converts nothing into something following tense vowels (i.e., $\phi + X/[+\text{tense}]$). Furthermore, although the satellite is not specified as [-syll],
all three satellites in (19) would be so marked since each is
tautosyllabic with a segment which must be the syllabic peak
\{[+syll]\}. This rule generates or inserts a non-syllabic
vowel (i.e., a glide) following certain tense vowels and must,
therefore, be regarded as a DIPHTHONGIZATION rule of limited
application. It may be compared to the SPE DIPHTHONGIZATION
rule, however, only in its general function. In SPE,
diphthongization is triggered by a tense vowel, but the
feature [back] determines which glide is inserted behind
which tense vowel: the [-back] glide [y] follows [-back]
vowels; the [+back] glide [w] follows [+back] vowels. In
addition, the glide itself must agree in roundness and back-
ness. Translating Krohn's feature [front] into SPE feature
[back] gives the segments of (20). It is apparent that the

| (20) | /ɔ̃/ | /aʊ/ | /a̱/ |
| Vowel Satellite | Vowel Satellite | Vowel Satellite |
| [+low] [+high] | [+low] [+high] | [+low] [+high] |
| [+round] [-round] | [-round] [+round] | [+round] [-round] |
| [+back] [-back] | [-back] [+back] | [+back] [-back] |

satellite segments may agree with the vowel segment in back-
ness (/aʊ/), in roundness (/a̱/), or in neither feature. One
wonders what generality about English phonology is captured
by this rule. Its inelegance becomes even more apparent when
one considers that this rule does not reduce the underlying
inventory of phonemes at all since each of the segments which
will produce the vowel-satellite sequence is different from
the homorganic tense vowel which will not produce the vowel-
satellite sequence.

In order to show that the complex SPE rules of DIPHTHONG-
IZATION and VOWEL SHIFT are unnecessary in explaining vowel
alternation, Krohn re-analyzes several of the same pairs of
words which Chomsky and Halle employ to demonstrate vowel
alternation and proposes that recognizing his [+low]
diphthongs /aɪ/, /ɔɪ/, and /aʊ/ can explain such vowel
alternation in a much simpler manner than the SPE "rule
laden" grammar can. He suggests that the vowels which under-
lie the pairs divine-divinity, extreme-extremity, and sane-
sanity are /aɪ/, /i/, and /e/ respectively, i.e., "not
distinct from the first member of each pair." He introduces
two rules which permit the derivation of the second member
of each set, a laxing rule, which is, he acknowledges, SPE
20.III & IV (CLUSTER LAXING and TRI-SYLLABIC LAXING) and a
VOWEL ALTERNATION rule (shown in (21) and (22)). The vowels

(21) LAXING rule

\[
V + [-\text{tense}] \quad \xrightarrow{\text{C \{ (C) ic, (C) ish, (C) V (C) V \}}} \\
\]

/aɪ/, /i/, and /e/ are laxed by this rule in the second
member of each set to [aɪ], [i], and [e] respectively. These
lax segments then undergo the VOWEL ALTERNATION rule.
(22) VOWEL ALTERNATION Rule  

\[
\begin{array}{c}
\text{Vowel} \\
\text{allow} \\
\beta_{high} \\
\text{-tense} + \text{Rule VA}
\end{array}
\rightarrow
\begin{array}{c}
\text{Vowel} \\
\text{ahigh} \\
\beta_{low} \\
\text{-tense} + \text{Rule VA}
\end{array}
\rightarrow
\begin{array}{c}
\text{Vowel} \\
\text{ahigh} \\
\text{-tense} + \text{Rule VA}
\end{array}
\rightarrow
\begin{array}{c}
\text{Vowel} \\
\text{-ahigh} \\
\text{-tense} + \text{Rule VA}
\end{array}
\]

Application of (22) changes \([a^1]\) to \([i]\), \([I]\) to \([e]\), and \([e]\) to \([a]\), the correct phonetic representations for divinity, extremity, and sanity respectively. Krohn (205) comments that forms which undergo VOWEL ALTERNATION must be so marked at the phonemic level for the application of the rule (\([+ \text{Rule VA}]\) where VA represents the rule number) in order to avoid the inappropriate application of the rule to other \([-\text{tense}]\) vowels as in pin, dish, pet, pen, etc.

Krohn also examines the alternation of back vowels in such forms as verbose-verbosity, harmony-harmonious-harmonic, and curious-curiosity. Krohn (206) proposes a LAX NONHIGH VOWELS ARE NOT ROUNDED rule which, in conjunction with SPE TENSING Rule (Rule 20b; 181), and VOWEL REDUCTION Rule (Rule 103; SPE:110-1) and Krohn's two previous rules, allows him to derive the appropriate surface alternations. The LAX NONHIGH VOWELS ARE NOT ROUNDED Rule (23) expresses a well-known gap in the phonetic representations of vowels in English and is a surface phonetic constraint.

(23) \[
\begin{array}{c}
\text{Vowel} \\
\text{-high} \\
\text{-tense}
\end{array}
\rightarrow
\begin{array}{c}
\text{-round}
\end{array}
\]
Krohn (211) also recognizes a [Yu] diphthong with the features [+front] + [round] as in such forms as pew, beauty, feud, view, and mute; he formulates a FRONT-ROUND SEQUENCING rule (24)

\[
\begin{align*}
\text{Vowel} & \quad \text{[Satellite]} & \quad \text{Vowel} \\
-\text{low} & \quad +\text{front} & \quad -\text{low} \\
+\text{high} & \quad +\text{front} & \quad +\text{high} \\
+\text{front} & \quad +\text{round} & \quad +\text{round} \\
+\text{tense} & \quad & +\text{tense}
\end{align*}
\]

which places the segments in their proper sequence. A yu-TENSING Rule (219)

\[
\begin{align*}
\text{yu} & \rightarrow [+\text{tense}] / \quad \underline{\underline{\underline{(C)V}}}
\end{align*}
\]

"tenses lax [Yu] when this diphthong is followed by a vowel which may or may not be preceded by a consonant" (211). Krohn notes the similarity between his rule and SPE Rule 52 (SPE:195). The yu-TENSING Rule participates in the derivation of sulphur-sulphuric and ambiguous-ambiguity. yu GLIDE DELETION Rule (parallel to SPE:232, Rule 123)

\[
\begin{align*}
\text{yu} & \rightarrow u \quad \text{in certain environments}
\end{align*}
\]

participates in the derivation of such pairs as assume-assumption, consume-consumption, deduce-deduction, produce-production, etc.

In none of the above derivations does Krohn recognize the phonetic vowel nucleus as containing both vowel and glide except for [aI], [oI], [aVo] and [yu]. In a note, he cites spectographic evidence which suggests to him that the phonetic
reflexes of the underlying forms [ɪ ə ʌ ŋ ɔ ɔ] are in fact not diphthongal at all (221) while /a̯/, /i̯/, and /a̯u̯/ clearly are. The glides [y] and [w], therefore, are generated by a limited diphthongization rule for only four underlying single segment phonemes, each of which contains a set of opposing feature such as [+high, +low] simultaneously. Krohn's dissatisfaction with SPE, based upon what he calls the "highly complex machinery" (217) by which the grammar derives even simple words, is belied by his reliance on SPE rules in his own "Summary of Rules." (27) lists the eleven rules Krohn gives in this study and identifies the source or nature of each.

(27) 1. Laxing—SPE:24, Rules 20.111 and IV
2. Tensing—SPE:181, Rule 206
3. Lax High Vowels Are Non-Low—surface phonetic constraint
4. Vowel Alternation—compare to SPE VOWEL SHIFT Rule
5. Yu-tensing—revision of SPE:195, Rule 52
7. Low-High Sequencing—compare to SPE Diphthong-ization
8. Front-Round Sequencing—compare to SPE:243, Rule 29
9. Rounded Vowels Are Nonfront—surface phonetic constraint
10. Lax Nonhigh Vowels Are Not Rounded—
(Add [-low] on the left of the arrow for
British Received Pron.)—surface phonetic
constraint.

11. Vowel Reduction—Unstressed lax vowels are
reduced to schwa—SPE:110-1, Rule 103.

While adoption or adaptation of generally recognized rules is
a perfectly legitimate method of improving the grammar, one
wonders how the substitution of a diphthongization rule with
limited application and a vowel shift rule (no matter what
it is called) which lowers vowels rather than raising them
can constitute an "improvement."

In addition, Krohn apparently wants to "have his cake
and eat it, too." In his concluding paragraph, Krohn argues
for the naturalist position that underlying segments are less
abstract "than has generally been assumed by generative
linguists." He also cites the spectographic evidence of
Lehiste and Peterson (1961:274-7) and Lehiste (1964:4-6) to
show that his "true" diphthongs actually exist in surface
speech. However, Krohn assumes the mentalist position when
he argues for the acceptance of his [+high]vowel height; he
declares that (a) the phonological and phonetic levels operate
differently, (b) "there is no reason to assume that the
ability of the human mind to organize the facts of natural
language is strictly limited to the behavior of the vocal
organs" (218), and (c) Chomsky himself has in many places
observed that "one must transcend mere observations of behavior if he wishes to make significant statements about mental structures and processes . . . . Perhaps the analysis of vowels presented here [in Krohn's article] can be regarded as additional evidence in support of his position" (218). Of course, Linguist A may argue against Linguist B's grammar on the grounds that it is too abstract and then justify his own even more abstract grammar by quoting Linguist B's arguments, but such a practice raises serious questions about consistency, if not intellectual honesty.

Halle

In response to criticism of the SPE grammar by linguists such as Wang, Imai, and Krohn, Halle (1977) restates arguments which led to the formulation of the DIPHTHONGIZATION and VOWEL SHIFT Rules. First, Halle (614) considers some of the contexts in English in which the vowel alternations of (28) occur. A second set of alternations seems to indicate a

(28)
\[\begin{align*}
&\text{āy-i divine-divinity} & &\text{crucify-crucifixion} & &\text{satire-satiric} \\
&\text{īy-e serene-serenity} & &\text{intervene-intervention} & &\text{hygiene-hygienic} \\
&\text{ēy-a sane-sanity} & &\text{abstain-abstention} & &\text{volcano-volcanic} \\
&\text{āw-ʌ profound-profundity} & &\text{---------------------} & &\text{---------------------} \\
&\text{ōw-ɑ verbose-verbosity} & &\text{---------------------} & &\text{cone-conic} \\
&\text{uw-ʌ} & &\text{reduce-reduction} & &\text{---------------------}
\end{align*}\]

similar process although the environments are quite different.
And examination of these two sets of alternations reveals that in each set, "a given monophthong alternates with a specific long tense diphthong." Halle (614) reports that in SPE he and Chomsky separated "the part that these rules had in common into two separate rules—the so-called VOWEL SHIFT rule [(30)] and the DIPHTHONGIZATION rule [see p. 20 of the present study] both of which apply to tense, long vowels."

(30) VOWEL SHIFT (SPE:243, Rule (33))

As in SPE, Halle also considers the process known as VELAR SOFTENING, a process which is separate from vowel alternation but which provides further support for the SPE formulation of VOWEL SHIFT. VELAR SOFTENING converts k into s and g into j in pairs such as those in (31) (Halle:615):
Analysis of the phonetic environment in which VELAR SOFTENING occurs does not reveal a pattern as readily as does an examination of the phonological representations before DIPHTHONGIZATION and VOWEL SHIFT Rules have applied. Halle (615) summarizes the context in which VELAR SOFTENING occurs in the informal rule (32).

\[
(32) \begin{cases} 
  k + s \\ 
  g \to j \\
\end{cases} \quad \{[-\text{low}, -\text{back}, +\text{syll}]\}
\]

The alternation of vowels in (28) and (29) provides separate and distinct support for positing VOWEL SHIFT. Further support arises from an examination of vowel alternations between present and past tense verb forms in English. Three types of alternations are discernible (Halle:615-6):

(33) a. lie-lay; eat-ate; choose-chose
drink-drank; sing-sang; begin-began; swim-swam;
sit-sat
b. find-found; bind-bound; break-broke; wear-wore
dig-dug; shrink-shrank
c. write-wrote; rise-rose; speak-spoke; freeze-froze
got-got; tread-trod
While an examination of phonetic vowel alternation in these forms reveals no simple generalization, Halle (616) observes that "the true generalization becomes apparent only when we represent the vowels in their underlying form. . . ." Examination of the underlying form reveals that the members of (33a) differ in lowness, those of (33b) differ in backness, and those of (33c) differ in both lowness and backness. Halle proposes two rules (34a) and (34b) which capture the vowel alternations shown in (31).

\[(34)\]
\[\begin{align*}
&\text{a. } \ V \rightarrow [+\text{low}, -\text{high}] \\
&\text{b. } \left[\begin{array}{c}
V \\
-\text{ahigh}
\end{array}\right] \rightarrow [+\text{back}, -\text{around}]
\end{align*}\]

These two readjustment rules belong "among the allomorphy rules of English" (616).

Halle (616) restates the three classes of cases to which SPE VOWEL SHIFT applies (35).

\[(35)\]
\[\begin{align*}
&\text{(a) Stressed tense vowels;} \\
&\text{(b) Vowels specifically marked with the diacritic feature } [+F]; \\
&\text{(c) The high lax back vowel } [u].
\end{align*}\]

Case b, which was "postulated specifically to handle vowel alternations in verb stems such as sit-sat, sing-sang, swim-swam" (616), is no longer necessary since (34) connects those verb forms to the observed vowel alternations in (33). Halle (617) points out that tense vowels which undergo (34) also
undergo VOWEL SHIFT. Halle's proposed allomorphy rule (34) represents an improvement over the SPE treatment since (in the SPE analysis) forms which undergo (34) have to undergo VOWEL SHIFT twice in order to be transformed into their proper shape.

Halle (617) also proposes that VOWEL SHIFT apply to all tense vowels rather than tense vowels which are stressed and which agree in roundness and backness. Consideration of words such as Catawba, impala, Alabama, and soprano, in which the present stress placement rules will assign stress properly only if the vowels are tense, led Chomsky and Halle to restrict VOWEL SHIFT to vowels which agree in roundness and backness in order to account for the fact that these stressed tense vowels do not undergo VOWEL SHIFT. Halle (618) proposes that the feature [tense] may be separate from the feature [long] and that long low vowels may be both tense and lax. His rule reproduced in (36) would necessitate modification of

\[(36) \quad \text{[long]} + \text{[tense]} / \{\text{-low} \text{-long}\}\]

the Stress Rule of English so that it would be sensitive to vowel length rather than tenseness. Thus the penultimate vowels in Catawba, impala, Alabama, and soprano would receive stress because of their length but would not undergo VOWEL SHIFT because of their lack of tenseness.
Another suggestion from Halle (621) is of particular interest to the present study. He proposes that the DIPHTHONGIZATION rule may follow VOWEL SHIFT and that y-PREPOSING inserts [y] before underlying /Λ/ "whenever [Λ] is tense or in an open syllable." His HIGH ROUNding rule (37),

(37) [+syl, +back, +high] → [+round]

formulated in order to round the [♀] product of [Λ] undergoing VOWEL SHIFT, combined with other SPE rules, yields the correct output for Bermuda, ambiguous, and angular as shown in (38) (622)

(38)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>y-Preposing</td>
<td>yΛ</td>
<td>yΛ</td>
<td>yΛ</td>
</tr>
<tr>
<td>Vowel Shift</td>
<td>yΓ</td>
<td>yΓ</td>
<td></td>
</tr>
<tr>
<td>High Rounding</td>
<td>yʊ</td>
<td>yʊ</td>
<td></td>
</tr>
<tr>
<td>Diphthongization</td>
<td>yʊw</td>
<td>yʊw</td>
<td></td>
</tr>
<tr>
<td>Vowel Reduction</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Output</td>
<td>[yʊw]</td>
<td>[yʊw]</td>
<td>[yə]</td>
</tr>
</tbody>
</table>

A final consideration concerns the back vowels [u] and the diphthong [3y]. Of the first, Halle (624) comments, "It should be noted that lax [u] does not participate in any morphophonemic alternations." He further observes that underlying /u/ "can be represented with its surface features." Of the rules under discussion in Halle's paper, none apply to [u].
The diphthong [oy], however, presents some problems. Unlike other complex vowel nuclei, this segment contains a front glide following a back vowel. Halle (624) observes that either we need a glide switching rule turning [w] to [y] after [ɔ], or we need to complicate Diphthongization so as to produce this result directly.

Halle suggests "the possibility of representing [ɔy] as underlying long [ū]." He confesses, however, that "the scarcity of examples . . . [makes] it . . . impossible to feel especially confident on this point" (624).

Halle's inventory of underlying vowels appears in (39), where his notation has been changed into a more conventional one, with a colon marking a long vowel and the macron marking tenseness.

```
(39)  -Back   +Back
      +High  i: i  ī: ī  ū: u
             e: e  ā: ā  ō: o
      -High  ā: ā  ĕ: ĕ  ō: ō
             a: a  ə: ə  o: (o)
```

Lax /ɔ/ is given in parentheses because it is not clear that it is necessary, since Halle now has a rule which lowers lax /ɔ/ to [ɔ] in such forms as got.

As a summary of the new Halle position, Figure 4 presents his analysis.
Fig. 4--The Halle (1977) system
Griggs

One final transformational generative analysis completes this representative survey of the variety of responses with which linguists have reacted to the SPE analysis. In his forthcoming study "Underlying /γ/ in English Phonology," Griggs gives a detailed account of considerations which led to the position regarding voiced velar spirants expressed in Griggs and Rulon (1974). The unpublished paper is important to the thesis being developed in this dissertation in two ways: in proposing alternate phonological sources for certain phonetically tense vowels, especially /εγ/ and /ογ/ for phonetic [(y)uw] and [ow] respectively, and in suggesting the possibility that English contains no instances of underlying /γ/ or /w/, which is precisely the contention of this dissertation.

Essentially, Griggs proposes to extend the SPE analysis of underlying voiceless velar spirants, i.e. /x/ and /xw/, which SPE assumes to underlie phonetic [h] and [hw] respectively, by recognizing voiced velar spirants, both /γ/ and /γw/, neither of which has any overt phonetic realization. Since SPE already recognizes intermediate [γ], from underlying /g/ in such forms as sign and paradigm, his proposed revision requires but minor adjustment and revision to the SPE descriptive framework. By means of these modifications, Griggs is able to account for some otherwise anomalous alternations, especially within the conjugation of irregular
verbs. Griggs' revision, then, was motivated by a desire to treat the alternations in such sets as grow-grew, slay-slew-slaughter, flee-fled-flight, and Hebrew-Hebraic as systematic rather than suppletive.

While the major portion of his paper is devoted to justifying his claim that English contains underlying voiced velar spirants, Griggs does comment briefly on the possibility of eliminating /y/ and /w/ from the inventory of systematic phonemes altogether, deriving all instances of phonetic [y] and [w] in the context #___V from underlying /y/ and /yw/ respectively. His arguments are generally distributional. He points out that his theory can justify underlying voiced velar spirants only in post-vocalic positions whereas he finds no need for recognizing such sounds in pre-vocalic positions. Griggs' observation is the reverse of the SPE treatment of /y/ and /w/, which Chomsky and Halle freely admit in pre-vocalic position but exclude from post-vocalic position, i.e., this is true because SPE does not admit underlying diphthongs. Such a distribution is clearly complementary, and Griggs suggests that, just as SPE derives the phonetic voiceless laryngeal glide from an underlying voiceless velar spirant, the two voiced oral glides [y] and [w] can be derived from underlying voiced velar spirants in at least some positions. Details of his analysis, which need not concern us here, have been omitted from the forms given in (37), intended to illustrate the general outline of his proposal.
However, since the idea that English might contain no glides lexically was tangential to his central purpose, Griggs did not argue strongly for its acceptance.

SPE analysis offers a generally sound framework which describes the behavior of vocalic nuclei in English. Chomsky and Halle fully intend their grammar to serve as a starting point from which linguists may begin their own revisions, redefinitions, and additions. The following section of this paper will treat in detail some of the problems inherent in SPE vowel analysis and will offer a solution which constitutes an improvement of SPE grammar.
CHAPTER III

PROBLEMS AND SOLUTIONS

Transformational generative phonological theory was first expressed in its most comprehensive form in Chomsky and Halle's *The Sound Pattern of English* (1968). Relevant to this analysis is the proposal that a syntactic component of the grammar generates a string of segments (i.e., a phonological representation) which represents a lexical entry marked for syntactic function. A sequence of generalized processes (i.e., phonological rules) which state predictable behavior of segments in specified environments alters the underlying phonological representation into a phonetic representation. Such a generative phonological grammar presupposes that the lexical component or inventory contains only those forms or that information which cannot be predicted by environment or function. Thus, for example, the lexical entry for any regular verb in English would contain no information about the formation of its past tense since the past tense symbol #d# can be predicted (i.e., inserted by rule); however, the lexical entry for an irregular verb in English would be marked to indicate whether the past tense of the verb is formed by ablauting the vowel in the stem (as in *sing*-sang) or by exempting the form from receiving the past tense phonological signal (as in *beat*-beat).
or by some other means. The generalized processes expressed in the ordered rules of the SPE transformational generative grammar, therefore, are statements concerning the predictable occurrence or behavior of phones.

Of the forty-three rules contained in the SPE grammar, thirty-six concern vowels and/or glides. While this analysis of English vowels can account for a large number of the phonetic representations of English morphemes, certain of its derivations do not achieve the degree of simplicity or elegance that others do. Krohn's (1972) analysis is essentially a reaction to the SPE concepts of DIPHTHONGIZATION and VOWEL SHIFT, especially in relation to the three recognized "true" diphthongs in English: [æy əw ɔy]. Imai's (1971) criticism centers on similar problems inherent in the SPE analysis. The present study is concerned with several troublesome SPE vowel analyses, specifically [ɔy ɔh əw əw ɔy].

Derivational Problems in SPE Analysis

Chomsky and Halle (1961) identify the surface phenomenon [ɔy] as one of the three "true" diphthongs (phonetically) in English. In their analysis of the phonological representation underlying [ɔy], Chomsky and Halle want to consider a monophthongal source since they have previously theorized that no vowel-glide sequences exist in lexical entries (52) and since the other two "true" diphthongs [æw] and [æy] derive from /ʊ/ and /i/, respectively" (191). They reason that if [ɔy] also derives from a monophthongal source which undergoes
the DIPHTHONGIZATION rule, its underlying vowel will have to be tense, nonback (because the glide element is nonback), low, and round. The vowel cannot be [ɔ], Chomsky and Halle argue, because it is not nonback; furthermore, the underlying vowel must not agree in roundness and backness because it must be exempted from VOWEL SHIFT. Chomsky and Halle determine that the vowel underlying [ɔy] must be the front, low, round /œ/. They find support for their supposition in the fact that /œ/ fills a gap in the inventory and that "the other three tense low vowels (namely, [æ], [ã], [ɔ]) do appear in lexical matrices" (192).

According to SPE treatment of vowels, underlying /œ/ undergoes the DIPHTHONGIZATION RULE to become [æy], a segment which is exempt from VOWEL SHIFT because it does not agree in roundness and backness. The rule which "makes a tense low vowel back before a nonback glide" (192), a rule which is necessary to convert [æy] to [ãy], also converts [æy] to [ɔy]. The derivations of boy, bow, and buy given in (1) demonstrate the transformations which, according to Chomsky and Halle, convert /œ u I/ into the three "true" phonetic diphthongs of English.

(1) /bœ  bu  bI/ Underlying
[boey  buw  biy] Diphthongization
bɔw  bɔy Vowel Shift
baw Rounding Adjustment
[boy  by] Backness Adjustment
(Here as several times throughout this section, the final phonetic form can be derived only by rules which have not been formulated in the summary of SPE rules in Chapter V. For instance, in their discussion of BACKNESS ADJUSTMENT, Chomsky and Halle (188-9) consider the switching of [əw] to [œw]; however, Rule (35) (244) does not make that transformation.)

The manner in which Chomsky and Halle deduce the vowel underlying [ɔy] exhibits the careful reasoning by which they arrive at all of their rules. However, the SPE analysis of [ɔy], while it reveals the relationship between the behavior of this diphthong and that of other tense vowels, presents a serious problem. First of all, linguists such as Imai (1975/71) question the specious segment /ɛ/. Citing Daniel Jones (1955), Imai (427) declares that /ɛ/ is "a totally implausible segment," one which "is not known to occur in any language." Imai contends that since Chomsky and Halle define the set of probable features as those which "represent the phonetic capabilities of man" (SPE: 294-5), they would agree that the same definition or limitation be placed on "permitted combinations" (427) of features.

More significant, however, is the fact that, unlike the vowel alternation in such pairs of words as explain-explanation, which is affected by TRI-SYLLABIC LAXING, [ɔy] as in exploit-exploitation never laxes and must, therefore, be exempted from the LAXING rule by some means. Chomsky and Halle are
forced to restrict the LAXING rule, much as they restrict VOWEL SHIFT, so that it does not apply to segments which do not agree in roundness and backness or to "add a special adjustment to the Tensing Rule so that it always tenses [ɔ̄]" (SPE: 192). Chomsky and Halle, then, are aware of the problem which their treatment of [ɔy] creates; but they cannot provide any but ad hoc alternatives.

Imai (1975/71) argues as does Krohn (1972) that the source of [ɔy] must be underlying /ɔy/. Krohn describes the segment as being marked with the features [+low, +high] simultaneously and posits a sequencing rule which separates the low vowel segment from the high glide segment. Imai observes that postulating /ɔy/ as the source of [ɔy] would necessitate some mechanism which would prevent the segment from undergoing DIPHTHONGIZATION and VOWEL SHIFT to become [ɔwy]. He concludes that the source of [ɔy] must be the lax diphthong /ɔy/. The lax first segment is exempted from VOWEL SHIFT and is tensed at some point after VOWEL SHIFT by Imai's rule (2).

(2) ɔ → [+tense]

Griggs' unpublished grammar recognizes the lax diphthong /ɔy/ as the underlying form of [ɔy]; details of his analysis are given in a subsequent section.

A second problem area in the SPE treatment of vowels involves the phonetic diphthong [ɔh] (or [ɔ^]) in SPE's
incomplete derivation; \([h]\) represents a non-syllabic \([\ddot{a}]\) and is a centering glide). Chomsky and Halle (206) declare that the underlying vowel must be excluded from VOWEL SHIFT and must be able to be converted to \([\ddot{a}]\) by a late rule of ROUNDED ADJUSTMENT which occurs at some point after VOWEL SHIFT. They propose that the underlying vowel must be /\(\ddot{a}\)/ because, since it does not agree in roundness and backness, it will be exempt from VOWEL SHIFT. SPE derives laud as follows.

\[
(3) \quad /\text{lad} / \\
\text{Underlying} \\
\text{læwd} \\
\text{Diphthongization} \\
\text{læud} \\
\text{Glide Vocalization} \\
\text{læod} \\
\text{Vowel Shift} \\
\text{lɔ̃d} \\
\text{Rounding Adjustment} \\
\text{[lɔ̃d]} \\
\text{Vowel Reduction}
\]

(A rule which converts \([e]\) to its nonsyllabic counterpart, not formulated in SPE, Chapter V will give the phonetic representation \([lɔ̃hd].\))

However, in examples such as father and Chicago in most dialects, \([\ddot{a}]\) clearly does not undergo ROUNDED ADJUSTMENT. Therefore, Chomsky and Halle argue that the \([\ddot{a}]\) underlying \([\ddot{a}]\) (\([\ddot{a}]\) in my notation) must be limited to monosyllabic forms, and a source for \([\ddot{a}]\) in polysyllabic forms must be found. Chomsky and Halle (207) suggest that \([\ddot{a}]\) and \([\ddot{a}\ddot{w}]\) or \([\ddot{a}\ddot{w}]\) occur in complementary distribution with each other:
[aw] (or [aew] in some dialects) occurs only in the context [+nasal] C or, in some dialects, in the context V. They observe that, "typically, [ɔ] does not appear in these contexts and [aw] or [aew] does not appear elsewhere in polysyllabic formatives." The vowel underlying both [ɔ] and [aw] in polysyllables, they deduce, is /ʊ/. In fact, they note, [ɔ] is "an intermediate stage in the derivation of [aw] (or [aew]) from /ʊ/." /ʊ/ becomes diphthongized to [uw]. Vowel Shift alters [uw] to [ɔw], which becomes [aw] by Rounding Adjustment. Since the environments in which /ʊ/ becomes [aw] are clearly distinct from those in which it becomes [ɔw] and since the difference between [ɔw] and [aw] is a matter of Rounding Adjustment, those forms of /ʊ/ which become [aw] undergo both Vowel Shift and Rounding Adjustment while those in which /ʊ/ goes only to [ɔw] undergo only Vowel Shift. The complementary distribution of [ɔw] and [aw] makes it possible to predict which forms of /ʊ/ will undergo which rules.

Chomsky and Halle (207) contend that "there is good reason to suppose that phonetic [ɔ] derives from underlying /ɑ/ in monosyllables and from underlying /ʊ/ in polysyllables." They also comment that the segment [ɔ] derived from either source cannot be "distinguished on phonetic grounds" from that derived from the other source. They also observe that the glide which follows [ɔ] from either source is [w]. [w] is inserted (by Diphthongization) following the back vowel.
GLIDE VOCALIZATION converts [w] to [u] following not only "all cases of [œ] but also after [ʊ] everywhere except in final syllables, before nasal clusters, and before vowels."

VOWEL SHIFT changes [u] to [o], and Rounding Adjustment generates [ʌ] from [o]. VOWEL REDUCTION converts [ʌ] to [ə], and an unspecified gliding rule changes [ə] to its non-syllabic counterpart designated by [h] in the present study. This process can be demonstrated in the derivation of maunder (SPE:208).

(4) /mʊdlin /

mʊwdlin Diphthongization
mʊudlin Glide Vocalization
mʊodlin Vowel Shift
mʊɔdlin Rounding Adjustment
[mʊədlin] Vowel Reduction

The SPE analysis of two sources underlying phonetic [ʌh], while ingenious, is not as elegant as would be a derivation for both mono- and polysyllabic words from a single source. There are, however, problems more serious than a lack of elegance related to the SPE derivation of [ʌh]. For instance, according to this analysis, paucity, augment, and plausible, if each is considered a polysyllabic morpheme, must be derived from /pʊk+iti ʊg+ment plʊz+ibl/. In such a treatment, however, paucity violates TRI-SYLLABIC LAXING and augment must somehow be kept from undergoing CLUSTER LAXING.
Furthermore, both **paucity** and **augment** violate a general constraint on English phonology which states that /u/ does not immediately precede a velar segment. It is possible that Chomsky and Halle might view **paucity** as arising from /p̥æk+iti/ (compare /x̕æk/ "hawk") and **plausible** as deriving from /plæz+ibl/ if each formative is regarded as a monosyllabic stem plus an affix. However, **TRI-SYLLABIC LAXING** would inappropriately lax /ʌ/, preventing the proper derivation of /ʌ/ to [ɔ] for monosyllabic words from occurring. The third source for [ɔ] is /o/ before anterior voiceless spirants (as in *moth, boss, and off*). If /o/ is taken as the underlying vowel in **paucity**, the derivation in (5) would obtain. (In this and subsequent derivations of polysyllabic forms, the foundary marker [+I] is omitted in all but underlying realizations in order to simplify the examples.)

\[
(5) \quad /p̥æk+iti/ \quad \text{Underlying} \\
\quad \text{poc iti} \quad \text{Velar Softening} \\
\quad \text{p̥ac iti} \quad \text{Tensing (SPE:23 IIIb)} \\
\quad \text{p̥ac itI} \quad \text{Tensing (SPE:23 IV)} \\
\quad \text{p̥as itI} \quad \text{Spirantization} \\
\quad \text{p̥as itI} \quad \text{Wedge Lowering} \\
\quad \text{p̥aws itIy} \quad \text{Diphthongization} \\
\quad \text{p̥aus itIy} \quad \text{Glide Vocalization} \\
\quad \text{p̥os itIy} \quad \text{Vowel Shift} \\
\quad \text{p̥os itIy} \quad \text{Rounding Adjustment} \\
\quad \text{p̥os etIy} \quad \text{Vowel Reduction}
\]
Neither augment nor plausible may be derived from this /o/ source since neither contains an anterior voiceless spirant segment immediately following the vowel and thus does not meet the environmental condition for the tensing of the /o/ of SPE:23 III b. Positing /o/ underlying the vowel in paucity and some other vowel underlying plausible and augment is counter-intuitive. Thus, neither paucity, plausible, nor augment can be successfully derived from /ʌ/, /ʊ/, or /o/ without violating general constraints on vowel-consonant sequences in English phonology or laxing rules which are well motivated by other considerations.

A third problem area for SPE is its inability to describe the ablaut relationship between the present and preterit of some verbs such as know-knew, grow-grew, see-saw. Chomsky and Halle (238) posit a readjustment rule (1) which attempts to account for ablaut.

(6) V \rightarrow [\text{-aback}] / [\text{-around}] in a number of irregular verbs, nouns, and adjectives in certain contexts

In their discussion of this rule, Chomsky and Halle (209) comment on the switching of backness and roundness which occurs in certain alternations:

If we take the present tense forms of verbs to be the underlying forms, then we have nonback vowels becoming back and round in the case of alternations such as cling-clung, tell-told, bind-bound, break-broke, and back vowels becoming nonback and nonround in the case of alternations such as run-ran, hold-held. Similarly, in irregular plurals we have back vowels becoming nonback and nonround as in mouse-mice, foot-feet.
The problem with this ablauting rule becomes readily apparent when one compares the derivations of such forms as know-knew, blow-blew, throw-threw, grow-grew. Intuition suggests that all four pairs are derived in the same manner. If /ɔ/ is posited as underlying the present tense forms and if the preterit forms are lexically marked for a double application of VOWEL SHIFT, the appropriate phonetic alternations can be produced. However, in some dialects, the preterit of know is realized as [nyūw], a form which arises from underlying /u/ and intermediate [T]. Griggs (forthcoming "γ" paper:7) points out that

since it is natural to derive all four of these verb forms in the same way, and since the absence of [y] in blew, grew, and threw presents no obstacle to such a uniform treatment—CH 38 deletes [y] in these contexts—the simplest grammar will surely derive all four from intermediate [ɬ]. Such a conclusion, however, would necessitate either multiple lexical entries or, equivalently, the addition of a lexically-determined readjustment rule expressing the bizarre ablaut /ɔ/ → /ɬ/.

Griggs and Rulon (1974:32-36) observe that the ablaut relationship cannot be accounted for by a rule such as SPE rule (1) which switches backness alone. They (33) posit a LOWNESS ADJUSTMENT rule (7)

(7) \[
\begin{array}{c}
\text{low} \\
+R \\
\end{array} \rightarrow \begin{array}{c}
\text{low} \\
\text{high} \\
\end{array}
\]

where R represents the number of the rule in their sequence. This rule switches the value of the feature [low] in forms marked for its application. Combined with SPE READJUSTMENT
Rule (1), Griggs and Rulon's LOWNESS ADJUSTMENT rule can properly produce the phonetic alternations in such pairs as *dig*-dug, *fall*-fell, *ride*-rode, *sing*-sang-sung, *take*-took, and *weave*-wove without a double application of VOWEL SHIFT, a device which the SPE treatment necessitated. Halle's (1977: 616) re-examination of SPE's VOWEL SHIFT contains a similar pair of rules which switch backness and roundness or lowness of certain morphemes (see Chapter II, (32) (a) and (b)).

A Partial Solution

Concerned for the inelegant or ad hoc solutions for the problems involved in the analysis of various phonetic representations detailed throughout this section, Griggs in an unpublished grammar proposes a vowel system which contains underlying lax diphthongs. He recognizes the following underlying segments: seven tense vowels /ɪ ɛ ʊ ɑ ɔ ʊ̯ ʊ̊/, five lax vowels /i e a o u/, and five lax diphthongs /ey ew aw oy ow/. The relationship between these phonemes and observed phones in stressed syllables is schematized in Figure 5. Of particular interest to us is his treatment of the lax diphthongs, examples of which are presented in (8). Since all

<table>
<thead>
<tr>
<th>(8)</th>
<th>/ey/</th>
<th>/ew/</th>
<th>/aw/</th>
<th>/oy/</th>
<th>/ow/</th>
</tr>
</thead>
<tbody>
<tr>
<td>prey</td>
<td>few</td>
<td>laud</td>
<td>boy</td>
<td>grow</td>
<td></td>
</tr>
<tr>
<td>veil</td>
<td>Eustace</td>
<td>augment</td>
<td>exploit</td>
<td>bowl</td>
<td></td>
</tr>
<tr>
<td>money</td>
<td>grew</td>
<td>maudlin</td>
<td>void</td>
<td>hollow</td>
<td></td>
</tr>
</tbody>
</table>

of these vowels are lax at the time of general laxing rules and VOWEL SHIFT, they are unaffected by these rules, and thus this analysis avoids some of the problems in SPE mentioned earlier. A post-VOWEL SHIFT tensing rule tenses the
Fig. 5--The Griggs system
vowel to produce the proper phonetic representation. This
treatment of vowels, for instance, posits underlying /oy/ for
forms such as exploit-exploitation and accounts for the
phonetic tenseness of the diphthong not as a violation of
TRI-SYLLABIC LAXING but by a very general late lax diphthong
tensing rule. Griggs' analysis provides a single source for
[ʃn] in both mono- and polysyllabic morphemes; thus the
phonetic vowel in both laud and augment derives from under-
lying /aw/. Finally, the analysis is able to describe the
ablaut relationship between pairs such as blow-blew, know-
knew, grow-grew which derive from underlying /ow/ forms that
are ablauted to /ew/ and reach their proper phonetic form as
a result of PEAK SHIFT (9)

(9) \( \frac{n}{ew} + \frac{n}{eu} \) where \( n \) = degree of stress

and [ɛ] RAISING (10).

(10) \( \varepsilon \rightarrow y/____V \)

A [yu] TENSING rule,

(11) \( u \rightarrow [\text{+tense}] / {\text{-round}} ) / y _____ \)

comparable to SPE 23 III, converts /u/ to [ɻ]. DIPHTHONG-
IZATION adds the segment [w] to [yɻ], but this form does not
undergo VOWEL SHIFT. Rounding adjustment for tense vowels
(12)
converts [yw] into [uw]. GLIDE ELISION (13)

\[
(13) \quad y + \phi \begin{cases} 
[+cor \ -ant \ -sonor] \\
[+cor \ +stress]
\end{cases}
\]

deletes the [y] segment in blew and grew while providing for its optional retention in those dialects which have [nyuw].

(There are serious problems in the formulation of this rule, all of which have been acknowledged; its exact formulation is of little concern at this point.)

While Griggs' analysis provides reasonable solutions for some of the problems of the SPE treatment, his claim that lax diphthongs underlie certain phonetically tense diphthongs is at variance with the SPE theory that there are no post-vocalic glides in underlying representations. However, his analysis does suggest an alternative solution which incorporates all of the merits of Griggs' treatment but does not violate SPE theory. While Griggs has not done so, Chomsky and Halle have ignored the strong evidence given by spelling that a pair of contiguous lax vowels, the second segment of which is [+high], may underlie [ey yw 5h 5y 6w] and have employed counter-intuitive ad hoc rules in order to derive these phonetic forms. Once Griggs has introduced the possibility that lax diphthongs underlie these forms, the problems of SPE analysis
previously cited disappear. More significant, however, is the fact that pairs of underlying contiguous lax vowels (i.e. /ei eu au oi ou/) combined with appropriate gliding rules will not only solve the same problems with as great an ease as Griggs' hypothesis of lax diphthongs can but also have the merit of adhering to SPE theory and will not encumber the inventory with the two additional segments necessary for Griggs' analysis.

The New Proposal

There is evidence that vowels may occur contiguously in phonological representations. Chomsky and Halle (236, fn. 1) observe that

there are, of course, sequences of vowels in underlying representations. These may occur across a formative boundary, as in scient-, which is phonologically /ski + ent/ (giving science, scientific by regular processes); or they may occur, marginally, within certain formatives, such as neo-, dia-, dial, fuel, via.

Further support for this observation comes from surface forms which take -ion, -ial, and other VVC combinations of suffixes. In addition, there are words such as create, hiatus, conduit, and triumph in which each of a pair of underlying contiguous vowels becomes the syllabic peak of its own syllable. (Although no entirely successful method for placing syllable boundaries has as yet been offered, I assume that the details of such a rule will appropriately place a syllable boundary between some pairs of underlying contiguous vowels in forms
such as create and triumph but will not place such a boundary between the lax vowels which surface as diphthongs.)

Further evidence for the observation that contiguous pairs of vowels may exist in underlying representations comes from such alternating pairs as fruit-ruaition, in which the augmented form clearly shows the presence of two underlying vowels which have had a syllable boundary inserted (compare similar forms such as intuit-intuition, in which both forms show the syllable boundary).

Problem forms such as Catawba provide additional support. In SPE, the form [kətəwba] must be derived from /kətəwba/. Notice that this representation violates a lexical redundancy constraint (SPE 239, rule (9)) which prohibits /ʊ/ from occurring before non-coronal consonants. Halle (1977) would derive the form from /kətəwba/, but, as I made clear in Chapter II, he is forced to make radical revisions in both stress assignment rules and VOWEL SHIFT. But at least, both of those systems yield the correct result. The Griggs system, on the other hand, apparently cannot handle the form at all. To derive the form from /katawba/ would predict the incorrect *[kətəwba]. If, however, the form is represented lexically as /katawba/, the stress rule will correctly stress the anti-penultimate vowel. Then, a rule of gliding, to be formulated below, will convert [au] into [aw].

Terminal [y] and [w]

In order to account for all phonetic occurrences of [y] and [w] which are not inserted by SPE DIPHTHONGIZATION and y-PREPOSING rules or modifications of these rules, several
gliding rules are required. Chomsky and Halle (SPE:240) propose only one gliding rule (14).

(14) \[
\begin{align*}
[-\text{back}] & \rightarrow \left\{ \left[ +\text{voc} \right] / C \quad [-\text{seg}] \right. \\
[+\text{high}] & \quad \left[ +\text{Cor} \right] \\
[-\text{cons}] & \quad \left. \left[ \text{stress} \right] / V \right\} x \\
\text{conditions: } & \ a = -, \text{ or } a \neq 1 \\
\text{x contains no internal #}
\end{align*}
\]

This rule combines a glide vocalization rule with SPE's only gliding rule; it represents Chomsky and Halle's treatment of terminal orthographic -\text{y} in forms such as aristocracy, telegraphy, felony, economy, and melody as well as "stem-forming" augments in alternating forms such as bile-bilious, professor-professorial, matter-material, and medal-medallion. Consideration of the alternating forms cited above as well as pairs such as habit-habitual and tempest-tempestuous leads Chomsky and Halle (129 ff.) to analyze the first of each of such pairs as containing a "stem-forming" vowel, either /i/ or /u/, in its lexical representation. Thus habit and tempest are represented as /h\text{abit} + u/ and /tempest + u/ while bile and professor are represented as /bI1 + i/ and /pr\text{o} + fes + Or + i/. (At this point in SPE discussion, Chomsky and Halle employ capital letters to represent tense vowels; thus /I/ is equal to /\text{f}/ and /O/ is the equivalent of /\text{e}/.) These "stem-forming" vowels are deleted from final position by a rule (SPE:130, 239) stated here as (15).
(15) \([u, i] \rightarrow \emptyset / + \) 

Obviously, then, the final orthographic \(-y\) in words such as aristocracy and industry, which must not be deleted by (15), must have an underlying representation which will prevent its deletion. In order to distinguish between stem-forming /i/ and terminal orthographic \(-y\), Chomsky and Halle employ the single feature \([\text{vocalic}]\) (corresponding to the feature \([\text{syllabic}]\) in the system of feature analysis employed in this study). Thus, they represent the stem-forming vowel as \([+\text{voc}]\) and the terminal \(-y\) as \([-\text{voc}]\), that is, as a glide, in the underlying representations. Stress placement rules substantiate such an analysis, for the glide segment is not counted as a syllable because it has no syllabic identity.

The first context of SPE rule (16), reproduced as (14) above, vocalizes the terminal glide posited for forms such as aristocracy and industry after STRESS PLACEMENT rules have appropriately assigned stress. The resulting vowel is tensed by SPE 23 IVa (242) because it occurs before a \# boundary. This final tense segment undergoes DIPHTHONGIZATION to become \([\text{i}y]\); however, since the segment has no stress, it will not undergo VOWEL SHIFT. (Halle's (1977) argument for altering SPE VOWEL SHIFT so that it applies to any tense vowel would improperly convert this final \([\text{i}y]\) into \([\text{a}y]\) or \([\text{a}y]\) as he acknowledges (622). Several of the problems which Halle's suggestion attempts to solve may be treated successfully without extending VOWEL SHIFT to stressless tense vowels; it
seems unnecessary, therefore, to change the constraints on VOWEL SHIFT as Halle suggests.)

Imai (1971) points out that the SPE decision to represent the final underlying segment of words such as aristocracy as /y/ is unwise. He contends that the final underlying segment must be /i/, which is marked for exceptional behavior in regard to stress assignment. More significantly, he observes that the so-called "stem-forming" vowels are not, as Chomsky and Halle contend, an inherent property of the stem; rather, /i/ and /u/ are attached to the affixes and represent allomorphic variants of the affixes. Thus, /i/ and /u/ need not be deleted from final position since neither occurs there if there is no phonetic reflex.

Imai's observations suggest that the glide vocalization context of SPE rule (16) (stated as (14) above) must be deleted. In addition, SPE rule (10) (given as (15) above) is also no longer necessary since there are no forms which require the deletion of final /i/ or /u/. As a result of this analysis of final orthographic /v/, the distribution of underlying /y/ is now limited to (16)

(16) [-seg] v,

identical to the distribution of underlying /w/.

There are problems associated with the SPE gliding rule shown in context b of (14) above. Chomsky and Halle (225 ff.) point out that context b of rule (14) does not apply where
C is either labial (as in *oblivion, champion, marsupial*) or velar (as in *Kentuckian, tracheal*); however, where C is dental or palato-alveolar, the context specified in rule (14), some forms undergo gliding while others which should do not. The rule which converts [i] to [y] applies to the words in Column I of (17) but does not apply to those in Column II (SPE:225-226).

<table>
<thead>
<tr>
<th>(17)</th>
<th>I</th>
<th>II</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a)</td>
<td>rebellious</td>
<td>punctilious</td>
</tr>
<tr>
<td></td>
<td>bilious</td>
<td>familial</td>
</tr>
<tr>
<td></td>
<td>Pennsylvania</td>
<td>Lithuania</td>
</tr>
<tr>
<td>(b)</td>
<td>pavilion</td>
<td>quaternion</td>
</tr>
<tr>
<td></td>
<td>battalion</td>
<td>accordion</td>
</tr>
<tr>
<td></td>
<td>onion</td>
<td>enchipiridion</td>
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<td></td>
<td>companion</td>
<td>ganglion</td>
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<tr>
<td>(c)</td>
<td></td>
<td>colonial</td>
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<tr>
<td></td>
<td></td>
<td>testimonial</td>
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<td>felonious</td>
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<td></td>
<td>ignominious</td>
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<tr>
<td>(d)</td>
<td>religious</td>
<td>criterion</td>
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<tr>
<td></td>
<td>admonition</td>
<td>clarion</td>
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<tr>
<td>(e)</td>
<td>partial</td>
<td>cardial</td>
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<tr>
<td></td>
<td>officious</td>
<td>invidious</td>
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<tr>
<td></td>
<td>Russian</td>
<td>lithium</td>
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<tr>
<td>(f)</td>
<td>invasion</td>
<td></td>
</tr>
<tr>
<td></td>
<td>confession</td>
<td></td>
</tr>
</tbody>
</table>
From their analysis of these forms, Chomsky and Halle (227) conclude that those items which undergo (14) must contain a + boundary while those which do not undergo the rule do not; a few marginal exceptions are lexically marked. As restricted, (14) appropriately glides iVC to yVC in the words given in Column I of (17).

As a result of my decision to accept Imai's treatment of terminal orthographic y, the SPE GLIDE-VOCALIZATION/GLIDING rule must be revised to exclude the first (GLIDE VOCALIZATION) context. Griggs (unpublished grammar:2) offers a revision of the SPE rule in his [i]-[e] GLIDING, given as (18) below.

\[
(18) \begin{align*}
\text{-cons} & \rightarrow \text{-syll} \\
\text{-back} & \\
\text{-low} & \\
\text{-stress} & \\
\text{conditions: where } a = \emptyset \text{ or } 1
\end{align*}
\]

The first context will convert [okean] to [okean] and [mari+a\text{}}] to [mary+a\text{}}]. The second context appropriately glides /i/ to /y/ in forms such as union, onion, medallion, and million. Griggs' [i]-[e] GLIDING rule will be incorporated in my grammar as an appropriate revision of the SPE GLIDING rule cited in (14). Word-final orthographic -y will be represented as /i/. Since word-final [w] occurs only following a vocalic segment, consideration of it will be reserved for the section on post-vocalic [y] and [w].
Initial [y] and [w]

Syllable-initial phonetic [y] and [w] arising from /i/ and /u/ present no problems, and the GLIDING rule which converts them into their proper phonological representations is, in fact, a READJUSTMENT rule which must be placed relatively early in the rule sequence. Data for the formulation of this rule includes examples such as (19).

(19) (a) wean, win, wane, wen, wine, woo, woah, wow
(b) yeast, yen, yam, you, yolk, yacht

The underlying representations of these examples are those given in (20).

(20) (a) /uēn uin uēn uen uIn uo uō uū
(b) /iēst ien iam iō iolk iēt

In order to produce the correct phonological representations, an early READJUSTMENT rule (21)

(21) $\left[ \begin{array}{c}
\text{cons} \\
\text{high} \\
\text{-tense}
\end{array} \right] \rightarrow \left[ \begin{array}{c}
\text{-syl} \\
\text{-seg}
\end{array} \right] \left[ \begin{array}{c}
\text{+syl}
\end{array} \right]

will convert /i/ to /y/ and /u/ to /w/. The context places the gliding element immediately before a vowel in order to block the application of this rule in forms such as in, is, us, and up. I assume that in words such as Iago, ion, and iodine, the tenseness of the initial /i/ blocks the application of the rule. The specification of [−seg] immediately
preceding the /i/ or /u/ segment permits forms such as always, unwind, and unyielding, each of which contains a prefix boundary, to be realized properly. This FORMATIVE-INITIAL GLIDING rule must precede ablauting in order to prevent the first \[V_{\text{+high}}\] segment in forms such as win-won from being switched inappropriately.

With the formulation of this FORMATIVE-INITIAL GLIDING rule combined with the re-analysis of final orthographic y, SPE's DIPHTHONGIZATION and y-PREPOSING rules, all phonetic [y] and [w] glides can be accounted for by rule. There are, at this point, no underlying glides in English phonology. However, several of the problems previously cited still have not been adequately solved. The following sections will consider [y] and [w] in the (C) C_V context as well as in post-vocalic position in order to provide answers to the questions which SPE analysis raises.

**Pre-vocalic [y] and [w]**

Both [y] and [w] occur in pre-vocalic position in the context (C) C_V. Of the two, fewer problems attend the formulation of the rule which inserts [w] in the context (C) C_V. The phonetic occurrence of [w] in the context (C) C_V is described by SPE rule (12), which also diphthongizes [a] preceding the liquids or a word boundary. SPE rule (12), given in part below as (22), inserts [w] following rounded consonants.
This rule accounts for the phonetic occurrence of pre-vocalic [w] not only following SPE's rounded consonants \[k^w\] \[g^w\] \[x^w\] as in quit, guava, and what but also following \[s^w\] as in sweep, swear, and sweater, \[t^w\] as in twist, twirl, and twinkle, and \[d^w\] as in dwell and dwindle. Since the application of this rule is triggered by the rounded consonant which precedes the vowel and not by a post-vocalic condition, I have separated the two contexts of the original SPE rule (12). \[w\]-INSERTION following rounded consonants occurs early in the sequence of phonological rules. Chomsky and Halle place it third, following an augment-deletion rule (given as (15) above), which I have deleted because it is unnecessary, and a rule which inserts \[u\] in the second of alternating forms such as table-tabular, miracle-miraculous. Griggs (unpublished grammar:2) places his \[w\]-INSERTION rule second in his phonological rules following his adaptation of SPE rule (11), \[u\]-INSERTION. This location in the rule sequence seems to be the reasonably correct one.

Pre-vocalic \[y\] in the context (C) C _ V occurs only before \[\ddot{u}w\] or its reduced counterparts \[u\] or \[\dot{a}\]. Linguists have been concerned about the derivation of \[y\ddot{u}w\] and have resorted to gimmicky methods of deriving the phonetic reflex. Chomsky and Halle, for instance, shift the \[u\] to \[\ddot{f}\] in order to permit the segment to undergo DIPHTHONGIZATION but to
prevent its undergoing VOWEL SHIFT. A late rule switches the roundness of \([yw] \) to \([yw] \). Krohn (1972) posits an underlying /wy/ segment which contains the features [+front, +round]. This segment undergoes a FRONT-ROUND SEQUENCING rule which produces a front satellite [y] followed by a high, round, tense vowel [u]. A subsequent Yu tensing rule again tenses the diphthong when it "is followed by a vowel which may or may not be preceded by a consonant" (211). His GLIDE DELETION rule deletes [y] in those forms where it is not required. Halle (1977:621) proposes that y-PREPOSING inserts [y] before underlying /y/ "whenever /y/ is tense or in an open syllable." VOWEL SHIFT will convert /y/ to [ɻ]. Halle suggests a HIGH ROUNDED rule which will alter [yɻ] to [yw]. In his unpublished grammar, Griggs posits two sources for [yw]: (1) /u/ in open syllables which yields to GLIDE INSERTION, which inserts [y] before a lax /u/ in an open syllable (as, for example, in cute, for which Griggs posits underlying /kute/) and (2) /ew/, which yields to a sequence of rules involving PEAK SHIFT (switching the syllabicity of a VC sequence to produce a GV sequence) and e-RAISING (in which [ɛ] produced by PEAK SHIFT becomes [y]). The [yu] product of both processes, which will be discussed in detail subsequently, is tensed and unrounded to [yɻ] by a [yu]-TENSING rule. DIPHTHONGIZATION and ROUNING ADJUSTMENT convert this [yɻ] sequence first into [yw] and finally into the appropriate [yw] form in a fashion similar to that proposed by Chomsky and Halle.
In the various \([yw]\) derivations sketched, one of the concerns has been to provide some means whereby \([y\ddot{u}]\) will undergo DIPHTHONGIZATION but will not undergo VOWEL SHIFT. Since lax vowels do not yield to either rule, the underlying and intermediate vowels are taken to be tense; however, some vowel other than \([\ddot{u}]\) must exist at some point in order to prevent VOWEL SHIFT (as it is formulated in SPE) from applying. With the exception of Krohn, the linguists cited previously have employed \([f]\) as an intermediate stage in the derivation of \([yw]\). Such an analysis requires a ROUNDED ADJUSTMENT rule to achieve the correct phonetic realization.

It is possible, however, to derive \([yw]\) in a manner which does not involve the obvious gimmick of first unrounding /\ddot{u}/ and then re-rounding it following VOWEL SHIFT. Words which have \([yw]\) in their phonetic realizations tend to have some orthographic commonalities; that is, by and large, such formatives are spelled with eu/ew as in sleuth, feud, eulogy, hewn, knew, preview or with uCe as in tube and cute. There are, of course, some exceptions such as Bermuda and remuda. These exceptions must have underlying tense /\ddot{u}/ in order for stress placement to operate properly. Like Colorado, piano, and Eldorado with /\ddot{a}/, these words may be lexically marked for exceptional behavior; the rule which laxes /\ddot{a}/ or /\ddot{u}/ in this environment is given in detail in a subsequent section of this chapter. The general consistency in the spelling of words with \([yw]\), however, suggests that Griggs is correct.
in part in viewing \[yw\] as arising from two different sources. His analysis bears examination.

For forms with orthographic eu/ew as in dew, news, sleuth, Griggs posits an underlying lax diphthong /ew/. PEAK SHIFT, reproduced as (23),

(23) \[
\begin{align*}
\text{n} & \text{ew} \rightarrow \text{n} \text{eu} \\
\text{n} & \text{e} \\
\text{ew} & \text{eu} \\
\end{align*}
\]
where \(n\) = degree of stress

switches the syllabicity and stress of the two segments. This rule (23) actually collapses several processes. First of all, the syllabicity of the [e] must be added to the [w], vocalizing [w] to [u] so that the segment may receive the stress previously assigned to [e]. As a result of its loss of syllabicity, [e] glides to its non-syllabic counterpart [ɛ]. A second rule, [ε]-RAISING, given as (24)

(24) \[ε + /y/ \rightarrow V\]

raises the glide [ɛ] to the glide [y] before a vowel. The product of these two rules is the sequence [yu].

For forms with the pattern uCe such as tube and cute, Griggs formulates a GLIDE INSERTION rule, shown in (25)

(25) \[φ + /y/ \rightarrow u\] in an open syllable

This rule inserts the high front glide before any lax [u] in an open syllable, that is, any lax [u] followed by a syllable boundary. Griggs' [yu]- TENSING rule, given as (26)
converts the lax vowel in [yɪ] from either the /eʊ/ or the /u/ source into [y+i], which is subsequently treated in much the same manner as SPE employs to derive [yʊw]. (See (27).)

Although Griggs' analysis ultimately proves to be as gimmicky as other [yʊw] derivations, his positing underlying lax vowels suggests a manner of deriving [yʊw] in a straightforward way. Let us suppose that [yʊw] has two underlying sources: lax /u/ in open syllables and /eʊ/ elsewhere. Different rules convert each of the sources into the [yu] sequence.

For forms which derive from /eʊ/, two rules are necessary, both suggested by Griggs' grammar. In the first stage, /e/ glides to /ɛ/ while the stress which /e/ has is shifted to the /u/, which becomes the syllable peak. This revised PEAK SHIFT rule is stated in (28)

\[
(28) \quad \frac{[e \text{-tense}]}{[\text{-stress}]} \quad \frac{[u \text{-tense}]}{[\text{-stress}]} \quad \rightarrow \quad [\text{y}] \\
1 \quad 2 \quad 3 \quad 4 \\
1 \quad 2 \quad 3 \quad 4 \\
[\text{-syll}] \quad [\text{astress}]
\]

The advantage of this rule over Griggs' is that both segments have syllabicacy before the rule applies; therefore, the transformation does not require syllabicacy deletion from one segment while adding syllabicacy and stress to a non-stressed,
(27) \textit{few} \quad \underline{tuna}

\begin{tabular}{ll}
/few/ & tuna/ \\
\textit{few} & PEAK SHIFT \\
\textit{fyu} & [\varepsilon] RAISING \\
\textit{tyuna} & [y] INSERTION \\
\textit{fy\text{\textbar}} & [\text{yu}] TENSING \\
\textit{ty\text{\textbar}na} & DIPHTHONGIZATION \\
\textit{fy\text{\textbar}w} & ROUNding ADJUSTMENT \\
\textit{ty\text{\textbar}w}na & \\
\textit{fy\text{\textbar}w} & \\
\textit{ty\text{\textbar}w}NA & \\
\textit{[fy\text{\textbar}w]} & ty\text{\textbar}wNE \\
\end{tabular}
non-syllabic segment. It is obvious that PEAK SHIFT must occur before any GLIDING rule in order to block forms such as [bleu] from being realized as [blew] instead of [bluw]. Griggs' [ɛ]-RAISING, cited as (24) above, raises [ɛ] to [y], producing the desired lax [yu] sequence for this source.

For these forms of [yũw] which arise from lax /u/ in the context uCe, Griggs' GLIDE INSERTION rule, (25) above, will correctly produce the lax [yu] sequence. (I assume that forms such as Bermuda and remuda may be marked lexically for [u]-LAXING at some point earlier in the grammar; at the time GLIDE INSERTION occurs, the lax [u] of these exceptions meet the conditions of the rule and will, therefore, have [y] inserted.)

At this point in the derivation of [yũw], the [yu] sequences from both sources fall together. However, instead of tensing and unrounding this lax sequence, let us suppose that [yu] undergoes a lax vowel DIPHTHONGIZATION rule of the order of (29).

(29) yu → yuw

There is some justification for supposing that some lax back vowels diphthongize. Griggs suggests that [o] obligatorily diphthongizes for formatives such as cold, old, and toll and that it is optionally diphthongized when it is stressless and occurs before a # boundary. Since Griggs does not recognize underlying lax /a/, he posits [a]-DIPHTHONGIZATION shown in (30)
to account for such forms as war, quart, salt, talk, and pall. It is possible that lax vowel diphthongization may extend much farther than has been suggested here; in any event, the fact that two lax back vowels seem to yield to diphthongization supports the present analysis.

If [yu] undergoes a LAX VOWEL DIPHTHONGIZATION rule of the order of (28), all that remains is a rule which will tense [u] in this context. Griggs' grammar, which is predicated upon the recognition of underlying lax diphthongs, provides such a rule. His late LAX DIPHTHONG TENSING rule reproduced here as (31),

\[
(31) \quad V + [\text{+tense}] / -\text{cons} -\text{syll} +\text{sonor}
\]

will appropriately produce [yūw]. A GLIDE ELISION rule of the order of (32)

\[
(32) \quad y + \phi / [\text{+cor} -\text{ant} -\text{sonor}] [\text{+cor} -\text{stress}]
\]

deletes [y] in those instances in which the surface realization is [ūw] rather than [yūw]. This sequence of rules gives both [nūw] and [nyūw] as the preterit of know and is sensitive
to the constraints on the co-occurrence of \([yw]\) in the 
(C) C_V conformation described in Chapter II.

This straightforward analysis of the derivation of \([yw]\) from two sources reflects the consideration being given to spelling in the present study. It also avoids unnecessary rounding-unrounding tactics whose sole purpose seems to be to block VOWEL SHIFT. As a result, SPE's Rounding Adjustment rule must be altered. The Rounding Adjustment rule which Chomsky and Halle (244) propose contains three contexts, one of which switches the roundness of tense vowels which agree in roundness and lowness. Context (b), given as (33)

\[
(33) \quad \begin{array}{c}
[\text{around}] \\
[+\text{back}] \\
[v]
\end{array} \rightarrow \begin{array}{c}
[-\text{around}] \\
\text{slow} \\
\text{round} \\
[+\text{tense}]
\end{array}
\]

converts \([\bar{a}]\) to \([\bar{o}]\) in forms such as cold, old, and toll and \([\bar{i}]\) to \([\bar{u}]\) in words with \([yw]\) following DIPHTHONGIZATION and Vowel Shift. If we accept the concept of lax back vowel diphthongization for \([a], [o], \) and \([yu]\), context (b) of SPE's Rounding Adjustment rule is obviated. Griggs' revision of SPE Rounding Adjustment, shown in (34), reflects his treatment of \([yw]\).

\[
(34) \quad \begin{array}{c}
[v] \\
[+\text{tense}] \\
[+\text{back}] \\
[\text{slow}]
\end{array} \rightarrow [-\text{around}]
\]

This rule, adopted for the present analysis, now expresses
the generalization about English phonology that tense back low vowels are non-round while tense, back, non-low vowels are round. Although (33) will round [٪] to [u], no forms in [ywiąz] will undergo the rule so that the rule operates vacuously.

Post-vocalic [y] and [w]

Many of the observed occurrences of post-vocalic [y] and [w] are accounted for by SPE analysis. DIPHTONGIZATION inserts a high glide following any tense vowel; GLIDE VOCALIZATION adds syllabicciy to the back glide following [ʊ ʌ], (and also, incidentally, [æ]), and VOWEL SHIFT operates on certain tense vowels as well as lax [u] following [ʊ ʌ æ]. (A later rule unrounds the [o] which arises from [u] through VOWEL SHIFT so that [ʌ] is achieved.) While I accept Chomsky and Halle's account of /I e a u o s/, I reject their contention that /e/ underlies [5y] and that /a 5/ underlie [5h] respectively in mono- and polysyllabic formatives. There is a better, more insightful manner of deriving these surface phenomena, a way which not only simplifies the derivations of [5h] and provides a non-specious phonological segment underlying [5y] but also permits a less complicated account of certain ablaut relationships between present and preterit verb forms.

Chomsky and Halle's theory that no post-vocalic glides exist in phonological representations imposes restrictions on the co-occurrence of [-cons] segments which are contrary to the available evidence. We must recognize the co-occurrence
of contiguous vowels in the phonological representations of
the forms in (35).

(35) a. triumph b. iodine c. create
    intuit-intuition ion Croat
    fruition Howard chaos
    vacuum hiatus eon
    radius-radii fuel

Analysis of the distinctive features of the underlying vowel
sequences shows that, while the tenseness of one of the vowels
in each pair is important for correct stress placement and
and phonetic realization, even more significant is vowel height.
The formatives in (35) demonstrate the following vowel height
patterns:

(36) a. \[
\begin{array}{c}
\text{V} \\
+\text{high}
\end{array}
\begin{array}{c}
\text{V} \\
+\text{high}
\end{array}
\]
b. \[
\begin{array}{c}
\text{V} \\
+\text{high}
\end{array}
\begin{array}{c}
\text{V} \\
-\text{high}
\end{array}
\]
c. \[
\begin{array}{c}
\text{V} \\
-\text{high}
\end{array}
\begin{array}{c}
\text{V} \\
-\text{high}
\end{array}
\]

The obvious gap in this paradigm is the co-occurrence sequence
\[
\begin{array}{c}
\text{V} \\
-\text{high}
\end{array}
\begin{array}{c}
\text{V} \\
+\text{high}
\end{array}
\]. This gap in contiguous vowel sequencing
strongly suggests that either there is a rather bizarre con-
straint on vowel co-occurrence, a restriction for which there
is no apparent motivation, or that some process yet undescribed
operates on the \[
\begin{array}{c}
\text{V} \\
-\text{high}
\end{array}
\begin{array}{c}
\text{V} \\
+\text{high}
\end{array}
\] pairing to obscure the phono-
logical vocalic clustering. It is this latter assumption
which prompts the present investigation. Thus, I contend that there are no restrictions on the co-occurrence of vowels in phonological representations and that forms such as those shown in (35), several of which present problems in SPE derivations, are underlain by phonological representations containing pairs of contiguous lax vowels of the \([V_{-\text{high}}]\ [V_{+\text{high}}]\) sequence.

(37) a. law b. boy c. grow-grew
maudlin toil know-knew
paucity hollow
augment shadow

Furthermore, consideration of the examples in (37), all of which are manifest phonetically as having \([V_{+\text{tense}}]\ [-\text{cons}][-\text{syl}]\) sequences, suggests that, when the pattern for underlying pairs of vowels is \([V_{-\text{high}}]\ [V_{+\text{high}}]\), a gliding rule as yet unformulated deletes the syllabicity of the second vowel and some rule which must occur after Vowel Shift tenses the first vowel.

The GLIDING rule necessary to delete the syllabicity of the second vocalic segment must be specified in such a way that the formatives in (35) will not be affected while those in (37) will. A rule of the order of (38) operates only on the examples in (37).

(38) \([-\text{cons}][V_{+\text{high}}][-\text{tense}] + [-\text{syl}] /[V_{-\text{high}}][-\text{tense}]\)
Triumph, intuit, fruition, etc. are not affected since all contain pairs of [+high] vowels. Create and Croat both contain pairs of [-high] vowels, while iodine, eon, ion, hiatus, and fuel contain a sequence in which the high vocalic segment precedes the low vowel. The formatives in (36), however, all contain the appropriate underlying \([-\text{high}] \quad [+\text{high}]\) collocation and are subject to the GLIDING rule (38). The product of the operation of GLIDING Rule (38) is a lax diphthong.

If the rules summarized in Chapter V of SPE are accepted as they stand, this GLIDING rule (38) must be ordered prior to the tensing rules in order to prevent SPE 23IV from tensing the first vocalic segment. However, even if GLIDING rule (38) operates to glide the second vocalic element before tensing can occur, another problem is caused by SPE 32, GLIDE VOCALIZATION, reproduced here as (39).

\[
(-\text{cons} \quad (+\text{back}) \rightarrow (+\text{voc}) \quad +\text{round} \\
\text{[high]} \quad [\text{V}]
\]

GLIDE VOCALIZATION converts \( [w] \) into \( [u] \) following \([\ddot{u} \ddot{a} \dot{a}] \). The purpose of GLIDE VOCALIZATION, which is placed between DIPHTHONGIZATION and VOWEL SHIFT, is to produce a lax \( [u] \) which will undergo context (c) of the VOWEL SHIFT rule to become \( [o] \); subsequently, Rounding Adjustment, SPE 34, unrounds this \( [o] \) to the \( [\Lambda] \) which appears in the \( [\ddot{5} \Lambda] \) sequence, Chomsky and Halle's designation of the diphthongal vocalic
nuclei in formatives such as laud and maudlin. VOWEL REDUCTION (SPE 43) converts [Æ] to [ə]. The rule which deletes the syllabicity from the [ə] segment thus derived is not included in the SPE rules. This sequence of rules, even without the final gliding rule, is reminiscent of the gimmick employed by Chomsky and Halle and other linguists of unrounding and re-rounding the vocalic segment of the [yuw] triphthong to block the application of VOWEL SHIFT in that case. Since the present analysis posits underlying contiguous lax vowels, the second of which is glided by GLIDING rule (38), it is counter-intuitive and non-productive to accept a sequence of rules which segment, then vocalizes it, and finally glides it again in order to generate a limited number of phonetic realizations.

An alternative method of achieving the desired phonetic representation of the centering glide [h] is suggested by two rules from Griggs' grammar. The first of these rules [u] LOWERING, is reproduced in (40).

(40)  $u \rightarrow [-\text{high}]$

As the rule is formulated, it lowers to [o] all instances of lax [u] which have not been blocked by an earlier readjustment rule (forms such as push, butch, pull, and bullet are exempted from [u]-LOWERING). This rule may be extended for the present analysis to include a context which will lower non-syllabic [u], that is, the glide [w], to non-syllabic [ə].
Context (a) must be blocked for forms of [yuw], which have lax [u] at this point in their derivation. Griggs' second rule is a lax vowel ROUNGING ADJUSTMENT rule, shown here as (42).

This rule unrounds the [o] of but and stuck (from /but stuk/) to [ʌ] and the [o] of got to [a]. This rule also may be extended to include the unrounding of non-syllabic segments.

The altered ROUNING ADJUSTMENT rule permits the non-syllabic [ŋ] produced by Context (b) of (41) to become [ŋ], a non-syllabic [ʌ], the second element appropriate for the sequence [ŋh]. Thus the process which SPE GLIDE VOCALIZATION attempts to do is here captured by a pair of rules which obviate the need for GLIDE VOCALIZATION: furthermore, (41) supersedes SPE Vowel SHIFT context (c).
GLIDING rule (38) produces a lax diphthong, which is not subject to VOWEL SHIFT. However, some means of tensing the lax vowel is necessary since no lax diphthongs appear in phonetic representations. Griggs' grammar, because it is predicated on the concept of underlying lax diphthongs, provides a late LAX DIPHTHONG TENSING rule which is useful here.

\[(44) \quad V \rightarrow [+\text{tense}] / [-\text{cons}] \quad [-\text{syll}] \quad [+\text{sonor}]\]

One other rule from Griggs' grammar is particularly applicable in the derivation of forms with underlying /au/. [ɔ]-TENSING, a rule which rounds and tenses /a/ in such derivations (and also tenses lax [ɔ]), has been formulated as follows by Griggs.

\[(45) \quad \left[ +\text{low} \quad +\text{back} \quad -\text{tense} \quad +\text{stress} \right] \rightarrow \left[ +\text{tense} \right] \quad \left[ +\text{cont} \quad -\text{ant} \quad -\text{voice} \right] \quad \left[ +\text{round} \quad +\text{tense} \quad +\text{round} \quad +\text{cont} \quad +\text{voice} \right] \quad \left[ -\text{syll} \quad +\text{back} \quad +\text{cont} \right] \quad \left[ +\text{voice} \right] \quad \left[ +\text{syll} \right] \quad \left[ +\text{voice} \right] \quad \left[ +\text{syll} \right] \quad \left[ +\text{voice} \right] \quad \left[ +\text{syll} \right] \quad \left[ +\text{voice} \right] \quad \left[ +\text{syll} \right] \quad \left[ +\text{voice} \right]\]

According to Griggs' note on this rule,

The top context gives [ɔ] in off, boss, etc. The lower context yields [ɔ] in law, caught, fought, form, long, and dog. For dialects which have [a] in dog, log, etc., replace [+voice] with [+sonor] in the bottom context.

Formatives such as paucity, augment, maudlin, and laud, all with phonetic [ɔh] present a number of problems for SPE
analysis, resulting in Chomsky and Halle's positing one
source for [ɔh] in monosyllabic words and a second source in
polysyllabic words. The examples in (46) indicate the ease
with which all of these formatives may be derived from a
single /au/ source through the application of GLIDING rule
(38), [u]-LOWERING (41), [ɔ]-TENSING (45), ROUNding ADJUST-
MENT (43), and VOWEL REDUCTION (SPE 43) (which has not been
reproduced here). Since [ɔ] is tensed by the rule which
rounds and tenses /a/, LAX DIPHTHONG TENSING applies
vacuously in these examples. It should be noted that non-
syllabic [ʌ] is the equivalent of [h]; thus these derivations
produce the correct phonetic realizations of [pɔhseti
ɔgment mɔhdlen 15hd].

According to SPE analysis, the [ɔy] of forms such as
boy and toil arise from underlying /ɔ/, a rounded front
vowel, as in /bɔ tɔl/. The tense segment /ɔ/ diphthong-
izes with the glide [y] because /ɔ/ is a front sound; how-
ever, the [ɔ] in [ɔy] does not undergo Vowel Shift because it
does not agree in roundness and backness. SPE Backness Adjust-
ment (35) converts the vocalic segment into [ɔy], giving
phonetic [bɔy tɔyl], for example, for the words cited above.
In principle, such a derivation is reasonable. In fact, such
a derivation depends upon the gimmick of positing an underly-
ing segment which has no overt phonetic realization.

The present analysis denies the existence of the segment
/ɔ/. It derives forms with surface [ɔy] from underlying /ɔi/
<table>
<thead>
<tr>
<th>(46)</th>
<th>/paʊkɪtɪ</th>
<th>augment</th>
<th>mauḍlin</th>
<th>laʊd/</th>
</tr>
</thead>
<tbody>
<tr>
<td>pauciti</td>
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<tr>
<td>pausiti</td>
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<tr>
<td>pawsiti</td>
<td>augment</td>
<td>mauḍlin</td>
<td>lawd</td>
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<td>pawsiti</td>
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<tr>
<td>pawsitêy</td>
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</tr>
<tr>
<td>pagsïty</td>
<td>augment</td>
<td>mauḍlin</td>
<td>laqð</td>
<td>[ʊ] Lowering (G51)</td>
</tr>
<tr>
<td>pøjgsïty</td>
<td>augment</td>
<td>møjḍlin</td>
<td>15øjd</td>
<td>[o] Tensing (G53)</td>
</tr>
<tr>
<td>pøjșity</td>
<td>augment</td>
<td>møjḍlin</td>
<td>15øjd</td>
<td>Rounding Adjustment (G54)</td>
</tr>
</tbody>
</table>
through the application of GLIDING rule (38), Griggs' [ɔ]-LOWERING, given as (47)

(47) [ɔ]-LOWERING

0 → [+low] except before [w]

and LAX DIPHTHONG TENSING (31). The derivations of boy and toil shown in (48) demonstrate.

(48) /boi toil/  
    boy toyl  Gliding Rule (38)  
    boy toy  [ɔ]-Lowering (47)  
    bɔy tɔyl  Lax Diphthong Tensing (31)

As previous examples in /au/ and /eu/ suggest, these formatives with underlying /oi/ support the idea that spelling and phonological representations may be much more similar to each other than has previously been theorized.

Further support for the contention that some surface diphthongs are underlain by pairs of contiguous lax vowels comes from the easy manner in which the ablaut relationship between present and preterit forms of some irregular verbs may be described. The derivations in (50) demonstrate that pairs such as blow-blew, and know-knew may have single lexical phonological entry in which the preterit is marked for the applications of an early readjustment rule which fronts the first vowel of a vowel sequence, similar to SPE (1), reproduced here as (49).

(49) \[ V_{aback} + [-_\text{round}] \]
The rules of PEAK SHIFT (27), [\varepsilon]-RAISING (24), GLIDING (38), [yu]-DIPHTHONGIZATION (29), GLIDE ELISION (32), and LAX DIPHTHONG TENSING (31) have been presented earlier in this chapter.

(50) /blou blou nou nou/ bleu bleu neu neu Ablaut (49)
bl\u01e9u bl\u01e9u n\u00e9u Peak Shift (28)
bl\u01f3u bl\u01f3u nyu -Raising (24)
blow blow now Gliding (38)
bl\u01f3uw bl\u01f3uw nyuw yu Diphthong-
ization (29)
bluw bluw nuw Glide Elision (32)
bl\u00f3w bl\u00f3w n\u00f3w ny\u00f3w ny\u00f3w Lax Diphthong
Tensing (31)

One of the forces which motivated the development of transformational generative analysis was the desire to show the relationship between pairs of words such as sane/sanity and divine/divinity which are obviously semantically related. The present analysis is, therefore, supported by the fact that it can show relationships between such semantically related words as shade/shadow and hole/hollow which neither SPE nor Griggs can do. Both shade and hole must have underlying tense vowels which are diphthongized and undergo Vowel Shift. However, shadow and hollow derive from intermediate forms with lax vowels in the first syllables. SPE, which would presumably derive these forms from /\textasciitilde s \tilde{\textasciitilde} d + o x \tilde{\textasciitilde} l + o/, cannot account systematically for these alternations. Nor can Griggs, who would derive these from / \textasciitilde s \tilde{\textasciitilde} d + ow x \tilde{\textasciitilde} l + ow/. 
One can account for the alternation between tense and lax vowels in shade/shadow and hole/hollow in the same manner in which Chomsky and Halle account for a similar alternation in sane/sanity and divine/divinity if the thesis of this dissertation that some surface diphthongs are underlain by pairs of contiguous lax vowels is accepted, that is, through the application of TRI-SYLLABIC LAXING, reproduced here as (51).

\[(51) \quad V \rightarrow [-\text{tense}] / \quad C \left[ -\text{stress} \right] \quad C_0 \left[ -\text{cons} \right] \]

We may take /śæd/ to underlie shade and /śæd + ou/ to underlie shadow, /xɔl/ to underlie hole and /xɔl + ou/ to underlie hollow. While the vowels in /śæd/ and /xɔl/ will be diphthongized and undergo VOWEL SHIFT, the tonic vowels in /śæd + ou/ and /xɔl + ou/ will be laxed by TRI-SYLLABIC LAXING to [śæd + ou xɔl + ou]. The derivations shown in (52) demonstrate the manner in which /śæd śædou xɔl xɔlou/ may be altered to the proper surface forms.

\[(52) \quad /śæd \quad śæd + ou \quad xɔl \quad xɔl + ou \quad śædou \quad xɔlou \quad Tri-Syllabic Laxing \]

\[\quad śædow \quad xɔlow \quad Gliding \]

\[\quad śæyd \quad xɔwl \quad Diphthongization \]

\[\quad śæyd \quad xɔwl \quad Velar Spirant Conversion \]

\[\quad hɔwl \quad holow \quad Rounding Adjustment--Lax Vowels \]

\[\quad halow \quad \]
Other pairs which exhibit this same alternation between tense and lax tonic vowels as a result of the application of Tri-Syllabic Laxing are shoal/shallow, holy/hallow, both pairs of which also undergo Ablaut, mead/meadow, and meal/mellow.

Another confirmation that the present thesis is a viable one relates to Halle's (1977, 617) assessment of SPE. In his re-evaluation of the conditions under which a vowel may be expected to undergo DIPHTHONGIZATION and VOWEL SHIFT, Halle considers the problems associated with forms such as these given in (53).

(53) Catawba Winnepesaukee Catawmet
impala Alabama soprano

Because the stress assignment rule is sensitive to vowel tenseness, it is assumed that the penultimate vowel in these forms is tense so that stress may be properly placed. However, in these six forms, the tense, stressed penultimate vowel would be subject to VOWEL SHIFT, which does not happen. Halle (618) suggests that this problem can be solved by a rule "which admits both tense and lax varieties among long vowels, but not elsewhere." Halle observes that such a rule would necessitate a modification of the Stress Rule of English so that it becomes "sensitive to vowel length rather than to tenseness as in SPE."
While, no doubt, Halle's revisions will produce the desired results, the present analysis makes any such revision unnecessary. The forms Catawba, Winnipesaukee, and Catawmet are underlain by the sequence /au/. The stress rule will place stress on the [a] segment of this sequence. GLIDING will produce [aw], which will become [5h] in the usual way. (The forms Alabama and soprano, while not underlain by contiguous lax vowels, can be derived in the present grammar through the application of [ǎ] LAXING and [a]-FRONTING; these rules are given in Chapter IV as Rules (17) and (34), respectively. There also a suggestion on how to derive impala in dialects which exhibit [ʍ] is found.)

Now four of the five collocations of lax vowels, the first nonhigh and the second high, which are subject to gliding rules have been discussed, leaving only the /ei/ sequence. Of his five lax diphthongs, Griggs admits in personal communication that the case for underlying /ey/ is the weakest of all his arguments. Morphological alternations are practically nonexistent, with prey-predator being perhaps the best candidate. The possibility of analyzing they, them, and their as arising from /e + i/, /e + m/, and /e + i + r/ respectively, while possible, is certainly dubious, since it uses function words, which tend in general to be highly idiosyncratic. On the other hand, the occurrence of this sequence in atonic position in certain words may provide the
best support for his claim. A peculiar alternation in English is that between [ʌ] and [ɑ] in *money-monetary*. If these can be viewed as deriving from underlying /mone + i/ and /mone + tɛri/ respectively, it may be possible to utilize some sort of tri-syllabic exemption for the former to prevent its tonic vowel from undergoing [o]-LOWERING. Griggs has not yet been able to formulate such a rule.

However, whether English *prey* is to be derived from /prɛɪ/ or /prɔɪ/ is immaterial to the central thesis of this paper. It was Griggs who claimed English had underlying /ey/ diphthongs. If he can show that it does, then I maintain that these should be analyzed as arising from underlying /ei/ sequences. If he cannot, then I am happy to return to the traditional /æ/ source for these vowels. The rules I have formulated in this chapter produce the desired results regardless of how the morphemes in question are represented in the lexicon.

Modifications to the rules of English phonology—both in new rules and revisions of existing rules—which I have proposed in this section have been discussed, in general, in isolation. Now it is necessary to show that these rules can be integrated into the full series of rules and yield the correct results. The various processes described, especially various kinds of gliding rules, are illustrated in the derivations in (54) and (55), each of which requires brief comment. First notice that the laxing of [ʊ a ɪ] in *Bermuda,*
(54)

<table>
<thead>
<tr>
<th>Bermuda</th>
<th>crude</th>
<th>piano</th>
<th>ritual</th>
<th>sleuth</th>
<th>uvula</th>
</tr>
</thead>
<tbody>
<tr>
<td>/ bermüda</td>
<td>krude</td>
<td>piäno</td>
<td>räitual</td>
<td>sleuë</td>
<td>uvula</td>
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<td>3 l</td>
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<td>l</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>bermuda</td>
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</tr>
</tbody>
</table>

bermyuda  kryude  rityual  yuwyula
bermyuwda  kryuwde  pianow
bermyuwda  pianow  rityuäl  yuwyula
bermyuwde  pianow  rityuäl
pliyana  pliyänow  rityuäl
pliyana

ričyuäl
kruwd
kruwd
bermyuwdæ  krüwd  pliyänow  sluwä  yuwyuäl
båmyuwdæ  piyana  ričuäl  yuwyuäl
[ båmyuwdæ  krüwd  piyana  pliyänow  ričuäl  sluwä  yuwyuäl ]

STRESS RULES
LAXING RULES
PEAK SHIFT (28)
[e] RAISING (24)
[y] INSERTION (25)
[yu] DIPHTHONGIZATION (29)
[o] DIPHTHONGIZATION
[o] LOWERING (47)
[a] FRONTING
FINAL [e] GLIDING
PRE-VOCALIC TENSING
DIPHTHONGIZATION
[u] LOWERING (41)
ROUND. ADJ.—LAX VOWELS (43)
PALATALIZATION
GLIDE ELISION (32)
[e] ELISION
LAX DIPHTHONG TENSING (44)
[r] COLORING
VOWEL REDUCTION

Phonetic
<table>
<thead>
<tr>
<th>old</th>
<th>quart</th>
<th>social</th>
<th>society</th>
<th>toil</th>
<th>win</th>
<th>yet</th>
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<tbody>
<tr>
<td>kwart</td>
<td>soki al</td>
<td>soki iti</td>
<td>toil</td>
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<td>iet /</td>
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<tr>
<td>kwart</td>
<td>socyal</td>
<td>sosiyati</td>
<td></td>
<td></td>
<td></td>
<td>win yet</td>
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<tr>
<td>kwawrt</td>
<td>sosyal</td>
<td>sosiyati</td>
<td>toy1</td>
<td></td>
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</tr>
<tr>
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<td>sowyal</td>
<td>sosiyatity</td>
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<tr>
<td>owld</td>
<td>sowyal</td>
<td>sosiyatity</td>
<td>tøyl</td>
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</tbody>
</table>

Phonetic
piano, ritual respectively is carried out by three different laxing rules: the vowel in ritual by TRI-SYLLABIC LAXING (an SPE rule); the vowel in piano by [a] LAXING (a rule from Griggs); and the vowel of Bermuda by what I call SPANISH [d] LAXING, a rule of my own creation. While this rule applies obligatorily to [ʊ] in the context _d V #, it apparently applies optionally to [ɔ] in those dialects which have [ɔ] instead of [ʌ] in Colorado and Nevada. Also observe that the stressless [u] in ritual and uvula are not diphthongized by [yu] DIPHTHONGIZATION. The [u] of ritual, however, like the [i] in piano, is tensed by PRE-VOCALIC TENSING and then is diphthongized by the general SPE rule. Since both vowels are stressless, however, VOWEL SHIFT is not applicable.

The derivations in (55) are intended to show how the various gliding rules may be integrated with existing rules. Note that the rule of [i e] GLIDING affects social but not society, where the [i] bears primary stress (nor in sociology, where the [i] is followed by a stressed vowel). Ocean, from /okean/, would derive like social.

That the thesis upon which this dissertation is based is a viable one seems more than reasonably demonstrated by the ease with which problems in derivation for the SPE grammar may be solved by application of the rules developed here. The ordering of these rules and their integration into a complete phonological grammar is presented in Chapter IV.
CHAPTER IV

SUMMARY OF RULES

No generative grammar is complete before its rules are ordered. Many critics of SPE have either chosen to ignore or failed to recognize this crucial requirement. The rules which are developed in Chapter III of this dissertation are here synthesized in a complete phonological grammar of English.

This summary of rules appears to be much longer and different in rule order from the Chomsky-Halle grammar given in Chapter V of SPE because it represents a modification of Griggs' 1978 unpublished grammar rather than a revision of the 1968 SPE rules. The Griggs grammar does not deviate from the Chomsky-Halle grammar in either principle or spirit; rather it represents the acme of thoughtful re-analysis which ten years of linguistic criticism have applied to that seminal work. As such, the Griggs grammar is an appropriate framework for my new analysis of certain vocalic nuclei.

The output of the rules summarized in this chapter is General American English as described in Chapter I of this dissertation. That the target dialect may differ somewhat from the reader's speech--just as it differs trivially from the writer's own--should be clearly understood.

In order to show the relationship of this grammar to those developed by Chomsky and Halle, Griggs and Rulon, and
Griggs, each rule in this summary has a parenthetical reference following its name. The parentheses contain an abbreviation for these grammars: SPE (Chapter V, Chomsky and Halle, 1968); GR (Section 7, Griggs and Rulon, 1974); or G (Griggs, 1978b), along with the number of the corresponding rule in that grammar. The absence of any parenthetical reference identifies the rule as being original to this dissertation. Bracketed references indicate an earlier section in the present work where the rule has been discussed; unless otherwise noted, this bracketed information refers to examples in Chapter III. A few minor rules bear the word minor in parentheses following the rule name.

Some of the rules in this summary require that a syllable boundary be recognized. Although linguists such as Hoard (1971) and Hooper (1972) have made pertinent observations regarding the placement of syllable boundaries, this grammar gives no rule for doing so. It is simply assumed that rules for the placement of syllable boundary do exist. The symbol [+SB] is used in rules to indicate that a syllable boundary is a requirement of the rule environment.

Following Chomsky and Halle, Griggs and Rulon, and Griggs, this summary of rules is divided into Readjustment and Phonological Rules. Other linguists (see, for instance, Aranoff, 1976) propose that the Readjustment Rules are appropriately a part of the morphological component rather than the phonological component of a grammar and suggest that
such rules be called rules of allomorphy. However, since this line of analysis is relatively new and since I include in my Readjustment Rules and INITIAL GLIDING rule which is primarily phonological in function, I have chosen to follow the SPE division of rules.

Some of the details of the rules summarized in this chapter differ from those in Chapter III. The rules in this chapter represent further refinements of those previously formulated.

Readjustment Rules

1. /#/ ELISION (Minor) \( \text{(GR 1)} \)
   
   \( \# \to \emptyset / [+\text{seg}] / [+\text{seg}] \)

2. /e/ ELISION \( \text{(cf. GR 2)} \)
   
   \( e \to \emptyset / C . \quad [+\text{-seg}] \)

3. INITIAL GLIDING \( \text{[ (21) ]} \)
   
   \( \left[ \begin{array}{c}
   -\text{cons} \\
   [+\text{high}]
   \end{array} \right] \to [-\text{syll}] \left/ \begin{array}{c}
   \#
   \end{array} \right] / \left[ +\text{syll} \right] \)

4. ABLAUT (Minor) \( \text{(SPE 1, GR 9)} \)
   
   \( \left[ \begin{array}{c}
   V \\
   \text{aback}
   \end{array} \right] \to [-\text{around}] \left/ [-\text{aback}] \right] \)

5. LOWNESS ADJUSTMENT (Minor) \( \text{(GR 10)} \)
   
   \( \left[ \begin{array}{c}
   V \\
   \text{alow}
   \end{array} \right] \to [-\text{low}] \left/ [-\text{high}] \right] \)

6. LAXING EXEMPTION \( \text{(SPE 4, G 7)} \)
   
   \( V \to [-\text{Rule 14}] / \left/ \begin{array}{c}
   [+\text{cor}] \\
   [+\text{ant}]
   \end{array} \right] / \left[ +\text{cor} \right] \left[ V \right] \left[ \# \right] \)
7. **PUSH/PULL RULE EXEMPTION** *(G 8; cf. SPE 8)*

\[
\begin{align*}
\text{[u]} \quad \text{-tense} & \quad \rightarrow \left[ -\text{Rule 46} \right] \\
\text{[ant]} & \quad \text{+sonor} \\
\text{-cor} & \quad \text{-nas.} \\
\end{align*}
\]

8. **GOOD COOK RULE EXEMPTION** *(GR 17)*

\[
\begin{align*}
\text{[o]} \quad \text{+tense} & \quad \rightarrow \left[ -\text{Rule 41} \right] \\
\text{k} & \quad \text{t} \\
\text{p} & \quad \text{d} \\
\end{align*}
\]

9. **LEXICAL REDUNDANCY** *(G 10; cf. SPE 9)*

\[
\begin{align*}
\text{[v]} \quad \text{+high} \quad \text{+back} \quad \text{+round} & \quad \rightarrow \left[ -\text{tense} \right] \\
\text{+cons} & \quad \text{-cor} \\
\end{align*}
\]

**Phonological Rules**

10. **[u] INSERTION** *(SPE 11, G 13)*

\[
\varnothing \rightarrow \text{[u]} \quad \left[ -\text{cons} \right] \\
\text{-cont.} \quad \text{l} \quad \text{VC} \quad \left[ -\text{seg} \right]
\]

11. **[w] INSERTION** *(SPE 12; G 14)*

\[
\varnothing \rightarrow \text{[w]} \quad \left[ +\text{cons} ight] \\
\text{+round} \quad \text{V}
\]

12. **STRESS ASSIGNMENT RULES** *(SPE 14-5, 17-9)*

**LAXING RULES**

13. **POST-PRIMARY LAXING** *(G 16; cf. SPE 201)*

\[
\begin{align*}
\text{V} \rightarrow & \left[ -\text{tense} \right] \left[ -\text{stress} \right] \\
& \left[ \text{l stress} \right] \text{C}_a \quad \text{C}_o \quad \left[ -\text{cons} \right] \\
& \left[ \text{astress} \right]
\end{align*}
\]

Cond where \(a = 4, 5\), etc.
14. CLUSTER LAXING

\[ V \rightarrow [-\text{tense}] \left/ \begin{array}{c}
\text{+cons} \\
\text{-sonor} \\
\text{+nasal}
\end{array} \right\] -cons \]

15. TRI-SYLLABIC LAXING

\[ V \rightarrow [-\text{tense}] \left/ \begin{array}{c}
\text{V} \\
\text{-stress} \\
C_o \\
\text{-cons}
\end{array} \right\] \]

16. SUFFIX LAXING

\[ V \rightarrow [-\text{tense}] \left/ \begin{array}{c}
C_o \\
\text{id} \\
\text{ik}
\end{array} \right\] \# \]

17. [\text{ā}] LAXING

\[ \text{ā} \rightarrow [-\text{tense}] \left/ \begin{array}{c}
\text{+son} \\
\text{+ant} \\
\text{+cons}
\end{array} \right\} V \# \]

This rule accounts for the penultimate stressing in words like \text{Alabama}, \text{piano}, and \text{impala} in those dialects in which the tonic vowel is [\#].

18. SPANISH [d] LAXING (Informal)

\[ \{\text{ū} \} \rightarrow [-\text{tense}] \left/ \begin{array}{c}
\text{d} \\
V \#
\end{array} \right\} \]

This rule is intended to account for oddities such as \text{Bermuda} and \text{barracuda}, and \text{Colorado} in those dialects in which the penultimate vowel is [yūw] and [ə] respectively. While application of this rule for forms with [ū] is obligatory, application for forms with [ā] are apparently dialectal.

19. VELAR SOFTENING

\[ [-\text{cont} \text{ant} \text{+Deriv.} \left/ \begin{array}{c}
\text{+cor} \\
\text{+strid}
\end{array} \right\} \rightarrow [-\text{cons} \text{+low} \text{-back}] \]
20. **PEAK SHIFT**

\[
\begin{array}{c}
\begin{array}{c}
\text{X} \\
\begin{array}{c}
\text{e} \\
\astress
\end{array} \\
\begin{array}{c}
\text{-tense} \\
\text{-tense}
\end{array}
\end{array}
\begin{array}{c}
\text{Y} \\
\begin{array}{c}
\text{u} \\
\astress
\end{array}
\end{array}
\end{array}
\end{array}
\]

\[
\begin{array}{cccc}
1 & 2 & 3 & 4 \\
[\text{-syll}] & [\text{-stress}] & [\astress]
\end{array}
\Rightarrow
\]

This rule desyllabicates, i.e., glides, the lax \[e\] and transfers to the following \[u\] whatever stress had previously been assigned to the \[e\].

21. **[i]-[e] GLIDING**

\[
\begin{array}{c}
\begin{array}{c}
\text{[-cons]}
\end{array} \\
\begin{array}{c}
\text{-back} \\
\text{-low} \\
\text{-stress}
\end{array}
\end{array}
\begin{array}{c}
\text{C} \\
\begin{array}{c}
\text{(+)} \\
\text{V}
\end{array} \\
\begin{array}{c}
\text{-stress}
\end{array}
\end{array}
\begin{array}{c}
\begin{array}{c}
\text{[+cor]}
\end{array} \\
\begin{array}{c}
\text{-back}
\end{array}
\end{array}
\begin{array}{c}
\begin{array}{c}
\text{V}
\end{array} \\
\begin{array}{c}
\text{-stress}
\end{array}
\end{array}
\end{array}
\]

\text{Cond where } a = \emptyset \text{ or } \neq 1.

22. **[e] RAISING**

\[
\begin{array}{c}
\varepsilon \\
\begin{array}{c}
\astress
\end{array}
\end{array}
\begin{array}{c}
\begin{array}{c}
\text{Y}
\end{array} \\
\begin{array}{c}
\text{V}
\end{array}
\end{array}
\begin{array}{c}
\begin{array}{c}
\text{V}
\end{array} \\
\begin{array}{c}
\text{V}
\end{array}
\end{array}
\]

23. **POST-VOCALIC GLIDING**

\[
\begin{array}{c}
\begin{array}{c}
\text{[-cons]}
\end{array} \\
\begin{array}{c}
\text{+high} \\
\text{+tense} \\
\text{-stress}
\end{array}
\end{array}
\begin{array}{c}
\begin{array}{c}
\text{[+cons]}
\end{array} \\
\begin{array}{c}
\text{+cont}
\end{array}
\end{array}
\begin{array}{c}
\begin{array}{c}
\text{[+strid]}
\end{array} \\
\begin{array}{c}
\text{[+voice]}
\end{array}
\end{array}
\begin{array}{c}
\begin{array}{c}
\text{V}
\end{array} \\
\begin{array}{c}
\text{V}
\end{array}
\end{array}
\begin{array}{c}
\begin{array}{c}
\text{V}
\end{array} \\
\begin{array}{c}
\text{K}
\end{array}
\end{array}
\begin{array}{c}
\begin{array}{c}
\text{V}
\end{array} \\
\begin{array}{c}
\text{[+cons]}
\end{array}
\end{array}
\begin{array}{c}
\begin{array}{c}
\text{[+sonor]}
\end{array}
\end{array}
\end{array}
\]

24. **SPIRANT VOICING**

\[V = \text{ }^{\text{V}} \\text{ }^{\text{V}} \\text{ }^{\text{K}} \\text{ }^{\text{V}} \\text{ }^{\text{V}} \text{ }^{\text{V}} \text{ }^{\text{V}} \]

---

\[1\text{Correct interpretation of this rule (and 48 below) depends on knowing that this writer describes English } [r] \text{ as being } [+\text{back}].\]
25. SPIRANTIZATION  

\[
\begin{align*}
\text{[+cor] + ant} & \quad \text{[+cont] + strid} \\
\text{[-sonor] + strid} & \quad \text{[-cont] - strid} \\
& \quad \text{[+voice] + ive} \\
& \quad \text{[+son]} \\
& \quad \text{[-cont] - voice} \\
& \quad \text{[-cons] - back} \\
& \quad \text{[-stress] [seg]} \\
\end{align*}
\]

26. [y] INSERTION  
\[\phi \rightarrow y / ___ u [+SB] \]

27. [yu] DIPHTHONGIZATION  
\[\phi \rightarrow w / y [u +stress] ___ \]

28. [o] DIPHTHONGIZATION  
\[\phi \rightarrow w / o [1c] # \]

Case (b) is optional.

29. [w] ELISION—PRE-VOCALIC  
\[\# C_1 - [-round] \]

30. [w] ELISION—POST-VOCALIC (Optional)  
\[\phi \rightarrow w / [V -stress] -low # \]

31. [o] LOWERING  
\[o \rightarrow [+low] \] except before [w]
32. [a] DIPHTHONGIZATION

\[ \begin{align*}
& \text{w} \rightarrow \text{w} / \text{a} \rightarrow / \text{l} \rightarrow \text{r} \\
& \text{C} \rightarrow \text{C} \\
& \text{#} \rightarrow \text{#}
\end{align*} \]

33. [a] TENSING

\[ a \rightarrow [+\text{tense}] / \text{l} \rightarrow \text{m} \rightarrow \text{#} \]

34. [a] FRONTING

\[ a \rightarrow [-\text{back}] \text{ except before } [\text{w}] \]

35. FINAL [e] GLIDING

\[ e \rightarrow [-\text{tense}] / [-\text{stress}] / [-\text{syll}] / \text{VC} \rightarrow \text{#} \]

36. ANGE TENSING

\[ a \rightarrow [+\text{tense}] / \text{nj} \rightarrow \text{e} \]

37. PRE-VOCALIC TENSING

\[ V \rightarrow [+\text{tense}] / V \]

38. PRE [CyV] TENSING

\[ V \rightarrow [+\text{tense}] / C \rightarrow V \]

39. FINAL VOWEL TENSING

\[ V \rightarrow [+\text{tense}] / \text{=} \rightarrow \text{#} \]
40. VELAR SPIRANT TENSING

\[ V_{-\text{back}} \rightarrow [+\text{tense}] \]

\[ [+\text{sonor} \quad +\text{cont} ] \]
\[ -\text{ant} \quad -\text{cor} \]

(G 43; cf. SPE 23V)

41. DIPHTHONGIZATION

\[ +\text{sonor} \]
\[ -\text{syll} \]
\[ -\text{cons} \]
\[ +\text{high} \]
\[ \text{around} \]
\[ \text{aback} \]

\[ V_{-\text{tense} \quad \text{aback}} \]

(G 46; cf. SPE 31)

Chapter II, (3)

Cond: blocked for \( [\tilde{a}] \)

42. IDENTICAL CONSONANT ELISION

\( C + \phi / \underline{C}' \) (where \( C \) is identical to \( C' \))

(SPE 28, GR)

43. VOWEL SHIFT

\[ V_{+\text{tense} \quad +\text{stress} \quad \gamma_{\text{back} \quad \gamma_{\text{round}}}} \]

\[ [+\text{high} \quad +\text{low} \quad \beta_{\text{high}} \quad \beta_{\text{low}}] \]

(G 48; cf. SPE 33)

This VOWEL SHIFT rule differs appreciably from SPE rule (33). Two of the three contexts which are stated in SPE (33) have been deleted because the present grammar provides a better description of the processes than SPE (33) does. Context (b) of SPE (33) accounts for some instances of alternations in the tonic vowels of present and preterit tenses of irregular verbs. In the present grammar, application of context (b) to lax vowels is handled by Lowness Adjustment (5). In certain cases such as \textit{grow-grew}, the recognition of underlying
contiguous lax vowels eliminates entirely the need for VOWEL SHIFT. Context (c) of SPE (33) is replaced in this analysis by the separate rule of [u]-LOWERING (46).

44. ROUNDING ADJUSTMENT--TENSE VOWELS
\[
\begin{array}{c}
V \\
+\text{tense} \\
+\text{back} \\
+\text{low}
\end{array} \rightarrow [-\text{round}]
\]

The SPE ROUNDING ADJUSTMENT RULE (34) contains one context which has the sole function of switching the roundness of [T] in the triphthongal sequence [yw] to the proper phonetic realization [yũw] after the sequence has been exempted from VOWEL SHIFT. Since the present analysis does not depend upon the intermediate [yw] sequence, my ROUNDING ADJUSTMENT rule excludes any context to switch the roundness of [T].

45. BACKNESS ADJUSTMENT
\[\bar{a} \rightarrow [+ \text{back}]\]

46. [u] LOWERING
\[
\begin{array}{c}
[-\text{cons}] \\
+\text{back} \\
-\text{tense}
\end{array} \rightarrow [-\text{high}]
\]\n
\[
\begin{array}{c}
+\text{syl} \\
\text{except before } [w]
\end{array}
\]

47. NASAL ASSIMILATION
\[
\begin{array}{c}
+\text{nasal}
\end{array} \rightarrow [\rho \epsilon] \sqrt{V \quad [-\text{sonor}]}
\]

Cond: nasal and obstruent are tautosyllabic and
\[\epsilon = \text{anterior, coronal, back, high, distributed.}\]
48. [ɔ] TENSING²

\[
\begin{array}{c}
+\text{low} \\
-\text{tense} \\
+\text{stress}
\end{array} \rightarrow
\begin{array}{c}
[+\text{tense}] \\
[+\text{round}]
\end{array} \rightarrow
\begin{array}{c}
[+\text{cont}] \\
+\text{ant} \\
-\text{voice}
\end{array}
\]

(G 53) 

((45))

49. ROUNDING ADJUSTMENT--LAX VOWELS

\[
\begin{array}{c}
-\text{cons} \\
-\text{tense} \\
+\text{back} \\
\text{high}
\end{array} \rightarrow
\begin{array}{c}
[\text{around}]
\end{array} \rightarrow
\begin{array}{c}
[+\text{syll}]
\end{array}
\]

(cf. G 54) 

((43))

50. PALATALIZATION

\[
\begin{array}{c}
-\text{sonor} \\
+\text{cor} \\
\text{high}
\end{array} \rightarrow
\begin{array}{c}
[+\text{ant}] \\
[+\text{strid}]
\end{array} \rightarrow
\begin{array}{c}
[\bar{\pi}] \\
[\bar{y}]
\end{array}
\]

(cf. SPE 37; G 55)

51. GLIDE ELISION

\[
\begin{array}{c}
-\text{sonor} \\
+\text{cor}
\end{array} \rightarrow
\begin{array}{c}
-\text{ant} \\
[+\text{stress}]
\end{array}
\]

(SPE 38; G 57) 

((13), (32))

52. [ɛ] ELISION

\[
\begin{array}{c}
\end{array}
\]

(G 58)

53. VELAR SPIRANT CONVERSION

\[
\begin{array}{c}
\text{-sonor} \\
+\text{cont} \\
-\text{ant} \\
-\text{cor}
\end{array} \rightarrow
\begin{array}{c}
\text{h} \\
[+\text{SB}] \\
[\text{-voice}] \\
[+\text{sonor}]
\end{array}
\]

(SPE 40, G 59)

\[
\text{$\phi$ / elsewhere}
\]

²See n. 1 above.
54. \([\emptyset]\) INSERTION—INFLECTIONAL  

\[ \emptyset \rightarrow \emptyset \]

\[ \begin{array}{c}
\begin{array}{c}
\text{Cond: If } a = \text{minus, then } \emptyset \text{ must also } = \text{minus.}
\end{array}
\end{array} \]

55. FINAL NASAL CLUSTER SIMPLIFICATION  

\[ [+\text{nasal}] \rightarrow \emptyset / [+\text{nasal}] \]

56. \([\emptyset]\) INSERTION—SYLLABIC RESONANT  

\[ \emptyset \rightarrow \emptyset \]

\[ \begin{array}{c}
\begin{array}{c}
\text{spe 42, g 62}
\end{array}
\end{array} \]

57. LAX DIPHTHONG TENSING  

\[ V \rightarrow [+\text{tense}] / [-\text{syl}l] [+\text{sonor}] \]

58. \([\text{r}]\)-COLORING  

\[ [-\text{cons}] \rightarrow [+\text{back}] / [-\text{high}] \]

59. \([\text{r}]\)-COLORED LAXING  

\[ V \rightarrow [-\text{back}] / [+\text{tense}] / [-\text{cons}] \]

60. \([l]\) ELISION  

\[ l \rightarrow \emptyset / V \]

Griggs (1978b, 6) observes that (60) is an oversimplification of "what is in fact a very complex process."

61. VOICED STOP ELISION  

\[ [-\text{sonor}] \rightarrow \emptyset / V [+\text{nasal}] \]

Griggs (1978b, 6) observes that (60) is an oversimplification of "what is in fact a very complex process."
62. [a] [ɔ] TENSING (G 68)

\[
\begin{align*}
\text{[+syll]} &= \\
\text{[+back]} &= \\
\text{[+low]} &= \\
\text{[+stress]} &= \\
\end{align*}
\rightarrow \text{[+tense]}
\]

63. LATE LAXING (GR 51; G 70)

\[V \rightarrow [\text{[-tense]}] / \phantom{____} [\text{[+cons]}] \]

64. VOWEL REDUCTION (SPE 43; G 71)

\[
\begin{align*}
\text{[-tense]} &\rightarrow e \\
\text{[-stress]} &
\end{align*}
\]

65. STRESSLESS TENSE VOWEL NEUTRALIZATION (G 72)

\[
\begin{align*}
\text{[-back]} &\rightarrow \text{[+high]} \\
\text{[+tense]} &\rightarrow \\
\text{[-stress]} &
\end{align*}
\]

66. SYLLABLE EXTREMITY DEVOICING (GR 47; G 73)

\[
\begin{align*}
\text{[-sonor]} &\rightarrow \text{[-voice]} / \text{[-voice]} \phantom{____} \text{[-syll]} \circ \text{[+SB]} \\
\end{align*}
\]
CHAPTER V

CONCLUSION

Any new phonological grammar is the result of attempts to solve problems more effectively than previously developed grammars can do. And, while each new grammar purports to be "a better mousetrap," no grammar to date, including the one developed in this dissertation, provides all the solutions to all of the problems. Certain matters which are not vital to this analysis may provide stimulus for future investigation.

One failure of the present grammar concerns the occurrence (at least in some dialects) of [ɔh] in final position in words such as Panama, Arkansas, and Omaha. Griggs does not provide a principled account of this sequence in this position. Ironically enough, the SPE rules appear to be able to do so but, in actuality, cannot. SPE rules predicate the transformation [ə] → [ɔh]; however, this process, which represents SPE analysis of the transformations which generate [lɔh] and [pɔh], applies to monosyllabic forms only. Therefore, the [ə] → [ɔh] process can in no way describe the derivation of the terminal sequence in the polysyllabic forms mentioned above. Furthermore, the present grammar, which posits [au] underlying both mono- and polysyllabic forms with surface [ɔh], comes no nearer solving this problem than do Chomsky and Halle. The sequence always occurs in absolute final
position and always has some degree of stress. However, these two conditions do not suggest any process whereby the proper phonetic realization may be derived.

Of some interest also is the influence of [l] when it occurs in post-vocalic position. Griggs (1978) exempts forms in which [u] is followed by [l] from undergoing [u] Lowering. Both [o] and [a] are diphthongized when they immediately precede [l] as in cold, old, toll and salt, talk, pall respectively. While the present grammar follows Griggs' (1978) explanation of the influence of post-vocalic [r] on the vowel which precedes it, there is a strong suggestion that both post-vocalic [l] and [r] need to be reanalyzed. The processes which these two liquids trigger are as yet poorly understood.

One minor question remains. In the present grammar, the presence of [w] in post-vocalic position blocks the application of [o]-Lowering, [a] Fronting, and [u] Lowering. Further study of the influence of the segment [w] in these environments may clarify two sets of processes which are posited in this grammar: lax back vowel diphthongization ([yu] Diphthongization, [o] Diphthongization, and [a] Diphthongization) and those rules which produce a kind of lax back vowel shift ([u] Lowering and Rounding Adjustment-Lax Vowels). That neither set of rules can be collapsed into a single rule suggests that the present analysis has failed to capture the generalization underlying these processes. In fact, the
behavior of the back vowels, both tense and lax, is peculiar enough to warrant further study. This dissertation, however, does not attempt to solve these problems.

The grammar developed in this dissertation does alter that proposed by Chomsky and Halle in several ways. While this grammar supports the SPE position on post-vocalic glides in the phonological representation, it denies any constraint on the co-occurrence of contiguous vowels in lexical representations. Rather, certain problematic derivations which are analyzed elsewhere as arising from underlying tense vowels or lax vowels which are tensed before DIPHTONGIZATION and VOWEL SHIFT are derived in this work from underlying contiguous lax vowels, the first of which is [-high] and the second of which is always [+high].

As a result of this grammar, certain SPE rules must be deleted. Rules 16 and 10, which concern the treatment of the augments [i] and [u] and their deletion when they are not needed as well as a gliding rule to describe the behavior of [i] in medallion, marriage, union, and onion have been deleted; an [i]-[e] GLIDING rule, which describes the only viable process remaining from Rules 16 and 10, replaces those two rules. Context (b) of SPE 34, Rounding Adjustment, a rule which describes the rounding of the segment [T] following VOWEL SHIFT, has been deleted since the phonetic product [yʊw] does not demand the previously posited unrounding-rerounding gimmick in order to avoid VOWEL SHIFT. Finally,
SPE 32, GLIDE VOCALIZATION, and SPE 33, context (c) have both been deleted. The process which permits the realization of [ʌ] or [h] is described as a non-syllabic vowel reduction which occurs in two steps: [u] ([w]) is lowered to [ɔ] in certain contexts, and [ɔ] is unrounded to [ʌ] ([h]) in the second phase.

Three new rules have been added to the grammar. A FORMATIVE-INITIAL GLIDING rule describes the process whereby initial [i] or [u] is converted to [y] and [w] respectively. A [yu]-DIPHTHONGIZATION rule, motivated by a need to derive [yūw] in a more straightforward manner than it has previously been derived and by the observations of Griggs regarding similar lax back vowel diphthongizations for [o] and [a], simplifies the derivation of [yūw]. Finally, a GLIDING rule appropriately converts the second, high vocalic segment in a pair of contiguous vowels into its glide counterpart.

Perhaps more significant than these deletions, revisions, and additions is the fact that this grammar reduces the SPE inventory of underlying phonemes by eliminating three: [ʌe y w], and Griggs' underlying inventory by eliminating two: [y w]. By so doing, this grammar moves toward a more general, more elegant grammar than any proposed before.
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