Chapter six

THE EVOLUTION OF THE MODERN ENGLISH VOWEL SYSTEM

1. Introductory remarks

In this chapter we review the vowel systems of four English dialects spoken in earlier centuries. Our purpose is to trace the evolution of the pivotal rules of the modern English vowel system—Diphthongization, Vowel Shift, and Rounding Adjustment—and to provide some explanation for the remarkable stability of the underlying system of representations. The four dialects examined below were chosen because they illustrate the main steps in the evolution. They do not, of course, constitute a single line of descent from the earliest to the latest; nor is any of them necessarily the lineal ancestor of the dialect of modern English that is described in the main part of this book. The dialects are, however, sufficiently closely related so as to provide us with a reasonably clear picture of the main lines of development.

1.1. ON LINGUISTIC CHANGE

In our view, a grammar of a language represents the linguistic competence of a speaker. In acquiring a language, a child does not memorize the utterances he hears; rather, he somehow utilizes these utterances to construct for himself a grammar, that is, a collection of rules in accordance with which he can produce and understand an unlimited number of utterances, many of them new to him and not similar in any significant sense to those previously encountered. The rules that constitute the grammar of a particular speaker determine in detail the form of the sentences that the speaker will produce and understand. If two speakers differ in the phonetic (or semantic) interpretation they assign to sentences, this difference can only be due to some difference in the character or organization of the rules that make up their respective grammars. Consequently an observed linguistic change can have only one source—a change in the grammar that underlies the observed utterances.

A straightforward way of effecting changes in a grammar is to add new rules. The addition of a rule to the phonological component may be regarded as the most rudimentary type of sound change. When such a change takes place, the added rule will satisfy the same formal constraints as the other rules of the phonological component. Many sound changes known in diachronic phonology are of this type. By and large the familiar "sound laws"

are, in fact, rules added to the phonological component, although one can easily imagine possible cases that could not be properly described in this way.

The conception of linguistic change as a change in the grammar is also implicit in the traditional views of sound change. One of the crucial facts that linguists have tried to explain is that speakers are by and large unaware of the changes that their language is undergoing. The reason for this, it has been claimed, is that changes affect only the phonetic actualization of particular sounds—and, moreover, in so slight a measure that the changes appear to be gradual. In other words, in this view, which we might call the "gradual" view of sound change, phonetic changes are restricted—with a few notable exceptions such as epenthesis, elision, and metathesis—to changes in the low-level phonetic rules that assign the precise numerical value to the different features in different contexts. Thus, vowels may be articulated somewhat farther back than before, or consonants may be actualized in some environment with aspiration of degree 4 whereas earlier they were actualized in that environment with degree 2. While there is no logical reason to reject this view of sound change, there is certainly no reason to give it special status. With the exception of the fact that speakers are unaware of an ongoing change—a fact which is easily explainable on the ground that speakers are, in general, unaware of the contents of their grammar—there is very little factual data to bear out this view. This embarrassing situation has not passed unnoticed. For example, Hoenigswald (1964) has written:

> . . . since it is surely difficult to imagine a speaker discoursing about an ongoing sound change, it was by no means unreasonable to think of sound change as gradual and hence imperceptible. The "sounds," the ranges of articulation, the statistical "maxima" of these ranges become more and more similar to each other in a nondistinctive way until, presumably, the harm is done, and the speakers (who would never have dreamed of dropping a given phonetic contrast of their own free will) are insidiously trapped—this seems to be the picture. So far as I know it has always been an entirely speculative picture whose best feature is a surface plausibility which it once possessed but does not possess any more. Are there any data that would bear it out? (p. 207)

The lack of evidence, however, has not prevented scholars from continuing to espouse the gradual view of sound change. Thus Hockett (1965) proposes to explain sound change precisely in the terms just sketched, without citing any actual instances. However, Hockett's exposition is notable for the fact that, unlike many writers on this subject, he explicitly recognizes the role that the rules of the grammar play in determining the physical shape of utterances. Thus the possibility arises immediately in Hockett's "stratificational" grammar, as it does in the grammar discussed here, that sound change—i.e., systematic changes in the phonetic actualization of particular utterances or parts of utterances—may be due to changes in the grammar other than in the low-level phonetic rules. For example, a change such as the Germanic spirantization of voiceless stops could readily arise if a rule were added to the component that in Hockett's grammar "maps strings of morphons into successions of bundles of distinctive features" (p. 200). Surprisingly, this possibility is not considered anywhere in Hockett's paper.[1]

In the traditional approach to sound change, a "sound law" is an observed correspondence between two stages of a language, a formula expressing the relationship between the phonological representation of formatives before and after the change. The effects of a

[1] For further discussion of Hockett's treatment of sound change, see Postal (1968, Chapter 14).

change, therefore, are incorporated directly into the lexical representations of individual formatives. In our approach, on the other hand, a rule that is added to the grammar may continue to function for many generations without causing changes in the lexical representations. Our view of sound change thus permits an explanation of the observations made by Bloomfield (1939) when he found, in a synchronic description of Menomini, that:

> our basic forms do bear some resemblance to those which would be set up for a description of Proto-Algonquian, some of our statements of alternation ... resemble those which would appear in a description of Proto-Algonquian, and the rest ... as to content and order, approximate the historical development from Proto-Algonquian to present-day Menomini (p. 106).

In the light of the preceding statements, the conclusion might be drawn that a grammar of a language contains nothing but rules that at one time or another were introduced into the language by the "operation" of a "sound law."[2] This does not happen to be the case: in synchronic grammars one finds numerous rules that cannot be traced directly to any sound change. Before we turn to actual examples, let us consider why this is so.

An essential feature of our theory of language is that it includes an evaluation measure which makes it possible to assign values to alternative grammars. It is on the basis of this evaluation measure that a child learning a language chooses one of the grammars (of which there are, in principle, infinitely many) compatible with the fairly restricted body of linguistic data to which he has been exposed. The grammar that a child constructs in learning his native tongue will therefore always be the one that ranks highest in terms of this evaluation measure.

It is easy to see that the addition of a given rule to a grammar G_1 may result in a grammar G_2 that produces the same linguistic forms as some other grammar G_3 yet is ranked lower than G_3 by the evaluation measure. We shall assume that when the language of adults undergoes such a change, their grammar is modified only by the addition of the rule in question.[3] When the children of these adults learn their native language from their parents, they will construct for themselves the highest ranking grammar G_3, which in principle may be quite different from G_2, the grammar of the parents. The fact that children and parents may have quite different grammars though speaking all but identical idiolects should hardly occasion surprise. When children learn their mother tongue, they are exposed not to its grammar directly but rather to the output of this grammar as it is actualized in the utterances of the parents, and it is on the basis of these utterances that children construct the grammar of the language. The children's grammar will contain a given phonological rule which corresponds to a historically attested change and is present in the grammar of their parents only if the grammar containing this rule is the most highly valued grammar in terms of the evaluation measure. In our discussion of the history of the English vowel system, we shall encounter changes such as the trisyllabic laxing rule (rule (19), Chapter Four), which has been carried over intact from the eleventh century into the contemporary language, and we shall also find changes where the particular rule that was added vanished

[2] Garde (1965), for example, reached this conclusion: "Nous arrivons donc à ce dilemme: ou bien les règles synchroniques sont une nouvelle formulation des lois diachroniques, ou bien elles sont fausses" (p. 145).

[3] One might speculate that the adult's inability to modify his grammar except by the addition or elimination of a few rules is one aspect of the well-known deterioration in the adult's capacity to acquire a new language.

from the contemporary language after having left appropriate traces in other parts of the grammar, in particular, in the representation of items in the lexicon and in new phonological rules.[4]

1.2. GENERAL COMMENTS ON THE EARLY HISTORY OF MODERN ENGLISH

Late Middle English is commonly assumed to have possessed the following simple vowels:

(1)

TENSE		LAX	
ī *time*	ū *town*	i *ship*	u *cut*
ē *meet*	ō *goose*	e *bed*	o *dog*
ǣ *mean*	ɔ̄ *boat*		
ā *hate*		a *man*	

In addition the language possessed a number of diphthongs which we shall assume were all made up of a tense vowel followed by a glide:

(2)

DIPHTHONGS		
ǣy *day, maid*	ɔ̄y *point*	ēw *new*
ǣw *dew*	ɔ̄w *blow, know*	āw *law, draw*

The diphthong represented here as /ēw/ derives historically from a number of sources (see Jespersen, 1909, pp. 101–102), among which are early ME *iw* and French *u*.[5] We shall assume that in late ME, i.e., at the stage of the language with which we are concerned here, this entity was represented as /ēw/, for this underlying representation results in the simplest grammar. If it is assumed that the underlying representation is /iw/, it would be necessary to add an ad hoc rule exempting this diphthong from an otherwise general tensing rule (see rule (4) below). In any event, we adopt the position of Jespersen and others who have held that in ME there were two, not three, diphthongs composed of front vowel and /w/. Some handbooks indicate that there was also a diphthong /uy/, but its status is quite unclear since sources differ as to the words that are supposed to exemplify /uy/.[6] We shall make the assumption that this diphthong occupied a marginal position in the language. Thus a few words, specifically marked in the dictionary, were allowed to contain /uy/, but otherwise the appropriate diphthong was /ɔ̄y/.

[4] It is obvious that the same development may take place when, instead of adding a rule, the language eliminates or changes an already existing rule. For further discussion of this question, see Kiparsky (1965).

[5] We shall not enter here into the involved question of whether Middle English had the sound [ü], but shall assume that this was not the case and that all English reflexes of foreign [ü] coincided with the contemporary reflexes of ME /ēw/. Our views in this matter have been decisively influenced by Zachrisson's study (1913). His conclusion that the diphthong /ēw/ and the French /y/ were both "pronounced *iu* or (ju.) . . . [and that] there is no conclusive evidence for the pronounciation (y)" (p. 223) seems to us correct. (See the survey of more recent literature in Danielsson (1963, pp. 113 f.))

[6] Jespersen (1909): "the early history of the diphthongs [ɔi and ui—NC/MH] is obscure: Luick's attempt to separate them is not successful" (p. 100). See also Dobson (1957), pages 910 f., and, especially, the last paragraph on page 823, where much evidence is presented showing that sixteenth century sources made no clear distinction between the two diphthongs. In view of this evidence it is somewhat surprising that Dobson draws from it the conclusion that "in the sixteenth and seventeenth centuries ME *ui* was still a falling diphthong [ui]."

The language had two phonological processes that affected the tenseness (traditionally the "quantity") of vowels. These processes, which are still productive in contemporary English (see (8), (19), (20), Chapter Four), are represented by the following rules:

(3) LAXING

$$V \rightarrow [-\text{tense}] \; / \; \text{——} \; [+\text{cons}] \begin{Bmatrix} \begin{bmatrix} -\text{voc} \\ +\text{cons} \end{bmatrix} & \text{(a)} \\ \begin{bmatrix} -\text{stress} \\ V \end{bmatrix} C_0 V & \text{(b)} \end{Bmatrix}$$

(4) TENSING

$$V \rightarrow [+\text{tense}] \; / \; \text{——} \; [-\text{cons}]$$

The Laxing Rule, essentially in the form given in (3), is quite old. According to Jordan (1934), laxing before double consonants is attested about the year 1000 (p. 41), and laxing in trisyllabic words before 1100 (p. 43). Rule (3) is not meant to exhaust all historically attested instances of laxing but is specifically restricted to those that are still operative in the contemporary language. For similar reasons we have given only one environment for tensing, although at different stages of the evolution of the language there were numerous other environments in which tensing took place (see Excursus 2 below). The environment in rule (4) is a special case of tensing in open syllable, a phenomenon well attested in English since at least the thirteenth century (Horn and Lehnert, 1954, p. 662).

Excursus 1. In his discussion of tenseness (length) of vowels in Romance borrowings, Luick (1907) observes that in bisyllabic words great variation is apparent. While some of the words, such as *banner, barrel, bottle, button, gallon, mutton,* show a lax vowel, others such as *basin, mason, label, bacon* show a tense vowel, and still others such as *lever* vacillate between a tense and a lax vowel. We should like to propose the following to account for this phenomenon. In borrowed words stressed vowels were tense in open syllables; for example, *chace, vile, close* (see Luick, 1907). It has been shown by Halle and Keyser (forthcoming) that as a result of the laxing of vowels in a final syllable that was either open or closed by a single consonant, stress was shifted in trisyllabic and longer words, from the final syllable to the antepenult if the penultimate syllable ended with a weak cluster; otherwise, stress shifted from the final syllable to the penult. Examples of the latter shift are provided by words such as *condition* in Chaucer. In certain lines this word has final stress, as indicated by the rime, e.g., with *resoun* (A. P. 39); on the other hand, in lines such as

O hateful harm! condicion of poverte (B. ML. 99)

the word must be stressed on the antepenult for the line to be metrically regular.

To account for these stress alternants, it must be assumed that in Chaucer's time the rule laxing vowels in final syllables was optional and, moreover, applied before the Stress Rule, whereas the rule tensing stressed vowels in Romance words, as well as the Laxing Rules (3a, b), must be assumed to have applied (synchronically) after the Stress Rule. The Laxing Rules (3a, b) are thus distinct and separate from the rule laxing vowels in final syllables.

Many ME inflected forms, e.g., plural forms, had an additional syllable (*baron–barones*). As a consequence, bisyllabic forms alternated with trisyllabic forms; i.e., a given word had case forms that were subject to the Laxing Rule (3b) as well as case forms that

were not subject to laxing. Hence, at that stage of the language, tense-lax alternations sometimes served as supplementary signals for the difference between singular and plural. Schematically the situation might be represented as follows:

(5)

galūn	galūn+es	bakūn	bakūn+es	
galun	galun+es	bakun	bakun+es	FINAL-SYLLABLE LAXING
gálun	gálun+es	bákun	bákun+es	STRESS RULE
gálun	gálun+es	bákun	bákun+es	STRESSED-VOWEL TENSING
gálun	gálun+es	bákun	bákun+es	LAXING RULE (3b)

When in the course of the further evolution of the language the /e/ of the plural suffix was lost, there were two types of bisyllabic words: those like (5), which had accompanying alternations between tense and lax vowels, and others which did not show such alternations. These tenseness alternations soon vanished, with the result that certain of the words were entered in the lexicon with tense vowels and others with lax vowels. Thus *gallon* now has a lax vowel, *bacon* a tense vowel, and *lever* (and perhaps a few other forms) vacillates between a tense and a lax vowel.

Excursus 2. In modern English tensing also takes place in the environment (6) (see rule (20b), Chapter Four):

(6)

$$\left[\frac{\quad}{-\text{high}}\right] C_1^1 \begin{bmatrix} -\text{cons} \\ -\text{back} \\ -\text{low} \\ -\text{stress} \end{bmatrix} \begin{bmatrix} +\text{voc} \\ -\text{cons} \end{bmatrix}$$

It is interesting to observe that the sixteenth century orthoepist Hart (see Section 2) does not have tensing in this environment. Thus he gives *grīk* with a tense /ē/ actualized as [ī], but *gresian* with lax [e]. Furthermore, Hart shows lax vowels in his transcriptions of *period*, *nasions*, *experience*, *komodiuzlei*, in the boldface positions, where in modern English, because of the extension of tensing to environment (6), we get tense vowels. By 1644 Hodges (see Kauter, 1930b) does have tensing in this environment, as shown by his transcriptions *pĕriod*, *Säviour*, *convĕnient*[7] (although *experience* is listed twice without any indication of tenseness).

In the fifteenth century English underwent what is traditionally known as the Great Vowel Shift. We have clear evidence of this from the early sixteenth century. "The long /i/ must . . . have become /ei/ about 1500; it is transcribed *ei* in the Welsh hymn written about that time" (Jespersen, 1909, p. 234). At about the same time tense /ē/ and /ō/ become [ī] and [ū], respectively. Jespersen (1909) notes that the development of special spellings for /ō/ and /ǣ/ distinct from those for /ō/ and /ē/ dates from this time only:

> . . . in ME each of the letters *e* and *o* denoted two long vowels, /e· ɛ·/ and /o· ɔ·/. This was not felt to be singular any more than it is in many other languages, and no effort was made to give graphical expression to the distinction. But in the middle of the 16th century we find the spelling *ie* coming into use for the close variety of *e*, and *ea* for the open, and at the same time *oa* becomes usual for the open o-sound . . . If we assume the values /i·/ in *field* and /u·/ in *too* coexisting with /ɛ·/ in *beast* and /ɔ·/ in *road*, we can easily see why people should have adopted distinct notations for sounds which had become thus widely separated from one another (pp. 233 f.)

7. The diaeresis is Hodges' device for indicating tenseness.

There has been a certain amount of discussion concerning the nature of the earliest (pre-seventeenth century) products of the Vowel Shift. In particular, Dobson, in his encyclopedic *English Pronunciation 1500–1700* (1957), concluded that the reflexes [ēy] and [ōw] of ME tense /ī/ and /ū/ could not have existed. He writes:

> The usual theory . . . is that ME *ī* developed through the stages [ei] [ɛi] [æi] to [ai]. This view is altogether impossible. If the development had been that suggested, ME *ī* would have crossed the path of ME *ai* developing to [æi] and [ɛi] . . . Yet the two sounds are always kept distinct, as they are still. ME *ī* can never have been [ɛi], and we must therefore admit that the orthoepists' transcription of ME *ī* as *ei* and their comparison of it with foreign [ɛi] sounds were not exact . . . (p. 660).
>
> It is often argued, on the basis of some of these identifications with foreign sounds and some of the analyses and transcriptions, that ME *ū* was diphthongized in the first instance to [ou], as it is similarly argued that ME *ī* was diphthongized to [ei] . . . But in this event ME *ū* would have become identical with ME *ou*, which remained as a diphthong long after ME *ū* had become one. It is obvious that they did not become identical; alleged rhymes between the two sounds are to be otherwise explained . . . (p. 684).

It is important to note that Dobson's conclusions concerning the pronunciation of these sounds in the sixteenth century are not based on evidence from the sources, but are rather inferences drawn on the assumption that sound change is a gradual process. Since what Dobson terms "the usual view" concerning the facts of sixteenth century pronunciation of ME tense /ī/ and /ū/ cannot be reconciled with a view of sound change as a gradual process, Dobson feels justified in interpreting away the statements and transcriptions to be found in sixteenth century sources. (Cf. Zachrisson (1913, p. 205, p. 207); Dobson (1957, pp. 659–60, p. 684); and see Section 2 for quotations from one of these sources, John Hart.) We have seen, however (Section 1.1), that the existence of gradual sound change is far from solidly established in spite of its very general acceptance. Therefore it does not in itself provide sufficient reason for rejecting explicit statements made by an observer such as Hart, whom Dobson himself ranks "among the greatest English phoneticians" (p. 62), and whose statements there is no other reason to doubt. Incidentally, in Hart's speech the ME nonhigh nonlow (mid) vowels were high monophthongs, whereas the ME high vowels had become nonhigh nonlow (mid) diphthongs which were distinct from the reflexes of the ME diphthongs. This simultaneous lowering and raising process—which is to be distinguished from the one referred to by Dobson—could be accounted for without difficulty even if one were to adopt the gradual view of sound change: the environments where /ī/ and /ū/ are lowered to [ē] and [ō] are distinct from those where /ē/ and /ō/ are raised to [ī] and [ū] since only reflexes of ME /ī/ and /ū/ were diphthongized in Hart. Finally, as will be shown, the appearance in the seventeenth century of [ʌy] and [ʌw] as reflexes of ME tense /ī/ and /ū/ is correlated with the appearance at the same time of [ʌ] as the reflex of lax /u/ and with a host of other phenomena which were unknown in the sixteenth century.

At this point in time, then, the nonlow tense vowels of Middle English had undergone the following changes:

(7)

ME	ī	ū	ē	ō
	↓	↓	↓	↓
	ēy	ōw[8]	ī	ū

[8] In the absence of evidence either for or against, we shall assume that the diphthongized vowels were not laxed at first.

To account for these changes, we propose that the following two ordered rules were added to the grammar of English in the fifteenth century:

(8) DIPHTHONGIZATION

$$\phi \rightarrow \begin{bmatrix} -\text{voc} \\ -\text{cons} \\ \alpha\text{back} \end{bmatrix} / \begin{bmatrix} +\text{voc} \\ -\text{cons} \\ +\text{tense} \\ +\text{high} \\ \alpha\text{back} \end{bmatrix} \text{——}$$

(9) VOWEL SHIFT

$$\begin{bmatrix} \alpha\text{high} \\ -\text{low} \end{bmatrix} \rightarrow [-\alpha\text{high}] / \begin{bmatrix} \text{——} \\ +\text{tense} \\ +\text{stress} \end{bmatrix}$$

That is, we assume that high tense vowels were diphthongized and that subsequently tense nonlow vowels under stress were subject to an exchange rule that turned high vowels into nonhigh vowels and nonhigh vowels into high vowels.

Although the two rules have to apply in the order indicated, we do not claim that they were added to the language in this order. It is possible that in this case the synchronic order coincides with the history of the language, but it is equally possible that rule (9) was added first and that subsequently rule (8) was introduced before rule (9) in the synchronic order of the rules. Since there appears to be no factual evidence that would allow us to decide what actually transpired, this question must remain open.

1.3. CONCERNING EXCHANGE RULES[9]

The proposed solution raises a number of issues that require comment. In particular, the role of exchange rules such as (9) in phonological change has been questioned on the basis that the addition of such rules to a grammar would result in a serious impairment of intelligibility between speakers who had adopted the change and those who had not. It might be claimed that it would be confusing if an exchange rule such as the Vowel Shift were added to a grammar since this would result, for example, in former [pūl] being pronounced [pōl], while former [pōl] would be pronounced [pūl]. One may reasonably doubt, however, that intelligibility between dialects would be impaired, for it is well known that intelligibility is only moderately affected in normal everyday speech even when all vowel contrasts are eliminated and a single vowel is made to stand in their place. A change like the one described would have very striking effects if subjects speaking a dialect that had not undergone the change in question had to identify correctly words in a randomly selected list. But word identification tests of this type, though valuable for testing the quality of telephone lines, are of only marginal value in determining the effects of a phonological change on intelligibility. It might be noted that a subject's performance on such a test would

[9] The comments in this section, as well as some in the preceding section, are in response to questions raised primarily by R. P. Stockwell, in particular in his "Realism in Historical English Phonology," presented at the Winter 1964 meeting of the Linguistic Society of America, and "Problems in the Interpretation of the Great English Vowel Shift," presented at Austin, Texas, January 1966. Since these papers have remained unpublished, we deal with the issues raised without attributing specific views to Stockwell or to any other person.

be even worse if the change undergone by the language had been a phonetic merger, a possible change about which there surely can be no question. We conclude, then, that intelligibility considerations cannot be advanced as reasons for excluding exchange rules as vehicles of phonological change.

It may also be observed that it is easy to construct situations in which exchange rules would not result in any conceivable impairment in either intelligibility or word identification. Consider a language with an ordinary five-vowel pattern /u o a e i/. If this language were subject to a rounding shift, the following correspondences would be established:

(10) u→i o→ʌ a→ɔ e→ö i→ü

All five of the vowels are kept distinct and there is a change only in the phonetic actualization. In such a situation there is likely to be no greater impairment of intelligibility than if each of the vowels had been slightly fronted or diphthongized. Consequently, if, as proposed above, intelligibility were the controlling factor, there would be no reason for excluding a rounding exchange rule. If, however, the language had also been subject to an umlauting rule which fronted back vowels in certain environments, then the addition of the exchange rule would result in the sort of phonetic switch that, according to the view under examination, is harmful to intelligibility, and the addition of the exchange rule could not be allowed.

This example brings out a further difficulty in the objection to exchange rules. Since it is impossible to tell from the form of a rule in isolation whether or not the addition of this rule would result in the type of phonetic switch that supposedly affects intelligibility, it may be necessary to check the derivations of all possible phonological phrases in order to determine this matter. This is a finite task, since an upper bound can realistically be imposed on the length of the phonological phrase. However, we feel that "global" conditions of this sort on the well-formedness of grammars should be excluded in principle. To allow such conditions would be to assert, in effect, that a check through all possible derivations must be performed by the speaker who is about to add a rule to his grammar, a supposition that is implausible in the extreme.

It should be noted, moreover, that, as we have just seen, the same impairment in a subject's performance on a word identification test would result if the language had originally contained the (by itself "harmless") rounding exchange rule and had added the umlaut rule later. In fact, if word identification were a factor in determining whether or not a rule could be added to a grammar, it would be necessary to check all possible derivations of the grammar before adding any rule at all, since phonetic shift ($a \rightarrow b$ while $b \rightarrow a$) can be produced by the addition of almost any type of rule. We describe a few such cases below.

A language may possess a pair of rules which have opposite effects in two distinct environments, and the two rules in question may, moreover, be adjacent in the synchronic order of the rules. This is by no means an unusual situation. It is found, for instance, in the phonology of English, where, as shown in rule (118) of Chapter Four, the glide [y] is replaced by the vowel [i] in one environment and the vowel [i] is replaced by the glide [y] in another environment. It can readily be imagined that subsequent changes in the grammar might result in a coalescence of the two environments, making the net effect of the two rules equivalent to a regular exchange rule which shifts the feature "vocalic" in some environment.

An exchange rule might also result from the addition of a rule to the grammar of a language which already contains a rule with precisely the opposite effect. For instance, consider a language that is subject to a rule assigning the feature [−low] to (i.e., raising) tense vowels which agree in backness and rounding. This rule, however, does not result in a merger with other nonhigh vowels, since by a (synchronically) prior rule, the latter nonhigh vowels become unrounded and back. More formally, we may say that the language has the following two ordered rules:

(11) (a) $\begin{bmatrix} -\text{high} \\ -\text{low} \end{bmatrix} \rightarrow \begin{bmatrix} -\text{round} \\ +\text{back} \end{bmatrix}$

(b) $\begin{bmatrix} \alpha\text{back} \\ \alpha\text{round} \end{bmatrix} \rightarrow [-\text{low}]$

Suppose that subsequently the language adds a rule lowering nonhigh vowels that do not agree in backness and rounding:

(12) $\begin{bmatrix} -\text{round} \\ +\text{back} \end{bmatrix} \rightarrow [+\text{low}]$

Once this happens, a simpler grammar is possible, namely, one including the exchange rule (13):

(13) $[\beta\text{low}] \rightarrow [-\beta\text{low}] \; / \; \begin{bmatrix} \underline{\quad} \\ \alpha\text{back} \\ \alpha\text{round} \\ -\text{high} \end{bmatrix}$

followed by a rule turning the resulting low vowels into [a]:

(14) $[+\text{low}] \rightarrow \begin{bmatrix} -\text{round} \\ +\text{back} \end{bmatrix}$

In this case the exchange rule results from the restructuring of a grammar that did not contain rules involving feature shift. Something quite similar to this might have happened in the evolution of the second part of the Vowel Shift in the dialect from which the variety of English described here is derived. (See Section 5.2 of this chapter.)

It is possible that the first stage of the Vowel Shift—i.e., rule (9)—is also the result of this type of restructuring. Subsequent to Diphthongization, tense nonlow monophthongs may have been made high (raised), and then the vowels that had previously been diphthongized—i.e., the originally high vowels—were made nonhigh (lowered). More formally, instead of rule (9) the language added rule (15):

(15) $\begin{bmatrix} -\text{low} \\ +\text{tense} \\ +\text{stress} \end{bmatrix} \rightarrow \begin{Bmatrix} [+\text{high}] \\ [-\text{high}] \end{Bmatrix} \; / \; \underline{\quad} \begin{bmatrix} -\text{voc} \\ -\text{cons} \end{bmatrix}$

Some of the dialectal evidence makes such an account quite plausible. At present, however, this is still far from established, and the possibility that (9) was added to the grammar directly cannot be ruled out. Moreover, even if research should ultimately determine that the first stage of the Vowel Shift is the result of restructuring, this would still not dispose of the possibility of exchange rules being added to a grammar directly.

As noted above, when phonological change is the result of the addition of a rule to a grammar, the added rule must satisfy the constraints that are placed on grammatical

rules in general. It is conceivable that the constraints on rules that can be added to a grammar may be more severe than those on rules that can figure in a grammar. At the present time, however, we do not know of any reason why these additional constraints (if there are such) should rule out exchange rules. In fact, we have just seen that the attempts to impose constraints ruling out certain types of exchange rules are without foundation. These attempts were based on the mistaken assumption that intelligibility is necessarily impaired when a few distinctive cues are obliterated; they lead not only to the imposition of inappropriate "global" conditions on phonological change but also to the formal exclusion of phonemic merger, i.e., the exclusion of a type of change that has been observed on numerous occasions. In sum, it seems to us that exchange rules, which are implicit in a notation that allows variables as coefficients of distinctive features, should be no more restricted than other types of phonological rules and, in particular, that exchange rules may be added to a grammar to produce phonological change.

The fact that the Laxing and Tensing Rules (3) and (4) in one form or another have figured continuously in the language from the eleventh century to the present is one of the reasons for the great stability of the underlying vowel system. It has been argued in Chapter Four that because of the presence of these two rules, Diphthongization and Vowel Shift must also be phonological rules of the language. The alternative would be to incorporate the effects of Diphthongization and Vowel Shift directly into the lexical representations of the formatives. This alternative, however, is not really open to us, since these effects would have to be included in both the Laxing Rule and the Tensing Rule as well; that is, the complicated facts of Diphthongization and Vowel Shift would have to be stated repeatedly in the grammar. On the other hand, by representing the tense vowels that have undergone Diphthongization and Vowel Shift as monophthongs—i.e., by assuming an underlying vowel system that approximates that of an earlier stage of the language—it is possible to give the Tensing and Laxing Rules in essentially the same simple form as in (3) and (4) and to state the complicated Diphthongization and Vowel Shift Rules only once. Since the ME diphthongs, unlike the tense vowels, did not generally participate in tenseness alternations, the historical changes to which they were subject were directly reflected in the underlying representations, with the result that diphthongs were ultimately eliminated from the underlying system altogether.

The preceding argument, which is basically a recapitulation of an argument presented in Chapter Four with regard to the facts of modern English, holds for earlier stages of the language as well, since both the Laxing and Tensing Rules have figured in the language for close to a thousand years. In the discussion that follows, we shall therefore assume that Diphthongization and Vowel Shift are an integral part of the phonological components of the various dialects examined and that the underlying vowel system in large measure resembles that of ME.

2. *John Hart (1551–1579)*

The first of the dialects to be examined is that of John Hart, who was a court official during the third quarter of the sixteenth century. His complete works on English spelling have been published in a careful edition by Bror Danielsson (1955 and 1963), and it is this edition that serves as the basis for our exposition.

2.1. THE EVIDENCE

Hart recognized five distinct pairs of tense and lax (in his terminology, long and short) vowel sounds, and he represented these by the letters *a e i o u*. According to Hart (Danielsson, 1955, p. 190) *a* is produced "with a wyde opening of the mouth as when a man yauneth." *e* is produced "with somewhat more closing the mouth [than *a*—NC/MH], thrusting softlye the inner part of the tongue to the inner and upper great teeth (or gummes for want of teeth)," and *i* "by pressing the tongue in like manner [as *e*—NC/MH] yet somewhat more forward and bringing the iawe somewhat more near." We shall therefore regard [a] as low, back, nonround; [e] as nonlow, nonhigh, nonback, nonround; and [i] as high, nonback, and nonround.

At first sight, Hart's description of the sound symbolized by the letter *o* may make it appear that he is referring to a low [ɔ] rather than to a nonlow [o], for he characterizes the sound of *o* as being formed "by taking awaye all the tongue from the teeth or gummes, as is sayde for the a, and turning the lippes round as a ring." This, however, cannot be taken to mean that the sound in question had the same low tongue position as [a], but only that it was "back," i.e., "awaye from all the teeth or gummes," for Hart characterizes *u* as being formed "by holding in *lyke manner* the tongue from touching the teeth or gummes (as is said of the a, and o)" [our italics—NC/MH]. In other words, Hart neglects (or is unable) to indicate differences in tongue height for back vowels. Since Hart's statements cannot be used to establish whether his *o* is low or nonlow, we shall assume that he meant nonlow [o] everywhere, since this assumption not only provides a more symmetrical vowel system but also leads to a somewhat simpler set of rules.

In addition Hart recognized a number of diphthongs. Of these there are several distinct types:

(a) Sequences consisting of a glide—[y] or [w]—followed by a vowel, e.g., *iē*, "yea"; *uī*, "we."
(b) Sequences of low vowel followed by a centralizing glide, e.g., *ōer*, "oar."
(c) Rising diphthongs consisting of a vowel followed by a glide. It is this class that requires some further comment.

Hart does not have special symbols for the glides [y] and [w] but represents them by the letters *i* and *u*, respectively. This is a direct consequence of Hart's general theory of spelling, which leads him to economize on symbols and use the same symbol to represent phonetically similar sounds in complementary distribution.

In the last of his works, Hart draws a distinction between the reflexes of ME tense /ū/, which he transcribes *ou* (i.e., with a lax vowel followed by *u*), and the reflexes of ME /ōw/, which he transcribes *ọu* (i.e., with a tense vowel followed by *u*). We assume, therefore, that for Hart the reflex of ME tense /ū/ was [ow], whereas the reflex of ME /ōw/ was [ōw]. As might be expected, Hart transcribes the reflex of ME tense /ī/ by *ei*, which we shall take as representing the pronunciation [ey].

As noted above (p. 255), a number of scholars, notably, Dobson (1957), have suggested that when Hart (as well as other sixteenth century sources) wrote *ou* and *ei*, he is to be understood as having meant [ʌw] and [ɣy] as reflexes of ME tense /ū/ and /ī/. There is no evidence in Hart's writings for such pronunciations, and it would seem unlikely that Hart would fail to record the absence of lip rounding in his reflex of ME /ū/, as is explicitly assumed by Dobson's transcription [ʌw]. We have seen above that Dobson's refusal to take Hart's evidence at face value stems from his conception of sound change as a gradual process.

As has already been indicated, this conception of sound change is without factual support. We have little reason, therefore, to impose extreme interpretations on Hart's perfectly plain statements and transcriptions in this case.

As further evidence against the view that Hart pronounced [ʌw] and [γy], we analyze briefly a comment by Gil (1621), who wrote fifty years after Hart, since this comment has been cited as tending to cast doubt on Hart's transcriptions and to support the alternative interpretation advanced by Dobson and others. The passage in question notes that Smith, a contemporary of Hart's, had been criticized "quod noui eius characteres nec aspectu grati sunt, nec scriptu faciles." This shortcoming, according to Gil, had been rectified by Hart to the best of his ability, but "ille, praeterquam quod nonnullas literas ad vsum pernecessarias omisit, sermonem nostrum characteribus suis non sequi, sed ducere meditabatur." Gil thus appears to feel that Hart's choice of symbols was a result of his wish to impose a particular pronunciation, which Gil did not approve of; and after citing a series of what he regards to be mistaken symbolizations in Hart, including in particular "ei pro I," Gil adds, "Non nostras his voces habes, sed Mopsarum fictitias." It should be noted, however, that regardless of whether one accepts Gil's criticism of Hart, it is clear from Gil's words that Hart's transcriptions represent an actual dialect, which Gil disapprovingly terms "Mopsarum fictitias." Gil's remarks were therefore intended to question the social acceptability of the pronunciation recorded by Hart, not its existence, which is the point at issue here.

We have already mentioned that in his last work Hart represented the reflex of the ME diphthong /ɔ̄w/ as [ōw]. This, however, is not the only reflex of this diphthong in Hart. In his earlier works, as well as in several places in the last work, the diphthong in question is transcribed by *ǫ*, i.e., by the same letter as the reflex of ME tense /ɔ̄/. We take this to represent the sound [ō].[10] (See (16), p. 263.) Against one's expectations, there is no similar vacillation with regard to the nonback partner of /ɔ̄w/: the reflex of ME /ǣy/ in Hart is uniformly transcribed *ę* and thus coalesces everywhere with the reflex of ME tense /ǣ/.

We are now faced with the question of whether the vacillations in Hart's transcriptions of ME /ɔ̄w/ represent actual vacillations in his speech or instead result only from certain inadequacies in his observations. We shall take the position that the latter was the case—that early in Hart's career he was unable to tell whether or not a tense [ō] was followed by a homorganic glide, whereas later he was able to distinguish between [ō] and [ōw]. A parallel question arises with regard to the absence of any distinction between the reflexes of ME /ǣy/ and /ǣ/. Here, too, we shall assume that Hart's evidence cannot be taken at face value and that in his speech the diphthongs had not been monophthongized.

(If, incidentally, Hart's transcriptions did accurately reflect his speech, we would have to modify the proposed set of rules (pp. 264–65) in the following way. We would have to add a rule monophthongizing low diphthongs except for /āw/. This rule would be obligatory for the reflex of /ǣy/ but optional for the reflex of /ɔ̄w/. We could generalize the Diphthong Laxing Rule (see rule (21)) to all vowels, provided that the optional diphthongal reflex of ME /ɔ̄w/

[10] Actually the vacillations are even more varied than indicated above. Thus Hart writes *ōu* for the words *own, bow, ho* (exclamation), *sew, sow, sole, mow* (Danielsson, 1955, p. 244), but he writes short *o* for *know* (seven times, though once *knōu*), *show* (three times), *bestowed*. Danielsson (1963, p. 154) believes that these spellings were a result of the fact that "Hart apparently considered the length mark superfluous in this case, but his pronunciation must have been *knǫ rǫ ʃǫ*." In any case, it is difficult to accept the spellings at face value, as was done by Dobson (1957, pp. 513–16), for as Danielsson and also Dobson himself note, English vowels are normally tensed in open syllables, and there is no evidence that vowels in open syllables were ever laxed.

were somehow exempted from laxing. These modifications, however, do not shed any new light on the evolution of the English vowel system. We have therefore adopted here the somewhat radical interpretation noted above. Our main purpose is as well served by the simpler facts as by the more complex facts that face us if we take Hart's transcriptions at face value.)

The reflex of the ME diphthong /ɔ̄y/ is normally represented with a lax first vowel. In the last of his works, however, Hart seems to make a distinction between two [oy] diphthongs, one with a lax vowel and the other with a tense vowel, although the diphthong with the tense vowel appears only in the one word *ọister*. The rarity of the appearance of a tense vowel in [oy] seems to us to be connected with Hart's inability, except at the very end of his career, to distinguish tenseness of vowels in diphthongs. As long as he regarded [ōw] as a monophthong, he had no contrasts in tenseness for vowels in diphthongs, and he quite naturally transcribed all diphthongal vowels without any indication of tenseness, that is, as lax. When in 1569 or 1570 Hart discovered that in addition to [ō] he also had [ōw], he realized that he had diphthongs that contrasted in the tenseness of the vowel, i.e., [ōw] from ME /ɔ̄w/ and [ow] from ME /ū/. His attempts to determine which diphthongs had tense vowels and which had lax vowels were apparently not successful. We shall therefore not rely on Hart's indications completely but shall assume that only the reflexes of ME nonlow vowels were laxed before glides. Thus the reflex of ME /ɔ̄y/, with a *low* vowel, is taken to be [ōy], with a tense vowel, throughout. In line with this decision, we shall interpret Hart's *au* in *lau* or *because*, which is a reflex of the ME diphthong /āw/, as representing [āw] phonetically.

The word *join* is transcribed twice in Hart as *dʒiuïn*, where the diaeresis above the *ï* indicates that this is *not* a diphthongal pronunciation. Since this is a totally isolated instance, we shall not attempt to offer an explanation for it, but shall regard it as a special idiosyncracy without systematic significance. It is worth stressing that this exhausts the evidence in Hart for the existence of a distinction between the diphthongs /uy/ and /ɔ̄y/.

The ME diphthong /ǣw/ appears in Hart's transcriptions as *eu* or *ieu*, which we interpret phonetically as [ēw] and [yēw], respectively. The transcription *eau* which appears in Hart's renderings of the words *beautify* and *ewer* will be regarded as an error (cf. Dobson, 1957, p. 803) or, at any rate, as being without systematic import. The occasional appearance of the [y] before this diphthong will be accounted for by a rule which inserts a glide before certain diphthongs (see rule (19a)). In this case the rule will be optional.

The reflexes of /ǣw/—that is, [ēw] and [yēw]—are kept distinct by Hart from those of ME /ēw, īw/ or Romance /ū̄/. Danielsson (1963) observes with regard to the latter reflexes:

> In this case it is evident that Hart did not use [ju] but [iu], as is also shown by his transcriptions ð'*ius* "the use" ... and *t'iuz* "to use" ... which indicate that the words begin with a vocalic element, i.e., most probably the first element of the falling diphthong *iu* (p. 133).

While we accept Danielsson's interpretations in general, it seems to us that his arguments here are not conclusive. The elision of the final weak-stressed vowel in ð'*ius* and *t'iuz* cannot be taken as evidence that the following word begins with a vowel. Hart's transcription ð'ʊ*alʃ*, "the Welsh" (Danielsson, 1955, p. 212), shows that weak-stressed vowels were elided before glides as well as before vowels. The transcription *iu* cannot represent a

vowel sequence since in such cases Hart uses a diaeresis on the second of the two vowels.[11] It would appear, therefore, that Hart's *iu* is either [yu] or [iw]. However, Hart (Danielsson, 1955) himself states:

> Lett us then . . . use the diphthong *iu* alwais for the sound of *you* and *u* in *suer*, *shut*, and *bruer*, and souch lyke, writing theim thus *siuer*, *shiut*, *briuer* (p. 131).

We conclude from this that Hart's *iu* stands for [yu] everywhere.

2.2. HART'S PATTERN

We have found in Hart's speech the following vowels and diphthongs (with optional variants enclosed in parentheses), exhibiting the indicated correspondences with ME vowels and diphthongs:

(16)

ME	ī	ē	ǣ	ā	ō	ō	ū
	↓	↓	↓	↓	↓	↓	↓
Hart	ey	ī	ē	ā	ō	ū	ow

ME	ēw	ǣw	ǣy	āw	ōw	ōy
	↓	↓	↓	↓	↓	↓
Hart	yu	(y)ēw	ēy	āw	ōw	ōy

ME	i	e	a	o	u
	↓	↓	↓	↓	↓
Hart	i	e	a	o	u

Hart gives numerous examples of the operation of the Laxing Rule. Thus we find alternations such as the following (see the index in Danielsson (1955)):

(17)

[ey]–[i]	*afein–afinite*
[ow]–[u]	*pronouns–pronunsiasion*
[ī]–[e]	*grīk–gresian, kīp–kept*
[ē]–[e]	*mēneθ–ment, lēv–left*
[ā]–[a]	*kompār–komparison* (also *komparizon*)

Examples of the alternations [ū]–[o] (e.g., *lose–lost*) and [ō]–[o] (e.g., *cone–conic*) are lacking. There can, however, be little doubt that such alternations were present in Hart's speech. Moreover, the rules to be postulated for his speech would in no way be simplified but would in fact have to be complicated if the absence of these examples were regarded as systematic rather than as fortuitous.

As already noted Hart's dialect did not have tensing in the environment (6), as shown by his transcriptions *period*, *gresian*, and *nasion*, with stressed vowels that are lax. Tensing of vowels before vowels was, however, characteristic of Hart's speech, as indicated by his transcriptions *leiön*, "lion," and *pouër*, "power," where the diaeresis is Hart's device for showing "2 voels (ioined in a word) being no diphthong" (Danielsson, 1955,

[11] "The last of the accents is the sondrer (which the latines cal divisio, and the grekes dyæresis).. for yt sheweth what voels are sundred in pronunciation, which in writing are ioyned together even as ar the diphthongs: as in voël, goïng, Poët, and souch lyke" (Danielsson, 1955, p. 155).

p. 147).[12] Unfortunately, word pairs such as *social–society*, *algebra–algebraic*, which would establish the Tensing Rule as productive in Hart's speech, are not found in his writing, although they are attested for the sixteenth century. In view of the fact that tensing is known to have been productive both before and after Hart, the absence of such examples will not be taken as proof that the Tensing Rule was not operative in Hart's dialect.

We are now ready to characterize Hart's vowel system more formally. We shall assume that in the lexical representations of Hart's grammar the following vowels and diphthongs were found:

(18)

TENSE			DIPHTHONGS					LAX	
ī		ū						i	u
ē		ō	ēw					e	o
ǣ	ā	ɔ̄	ǣw	ǣy	āw	ɔ̄w	ɔ̄y	a	

These segments were subject to the rules of the phonological component, which included the Laxing Rule (3) and the Tensing Rule (4). The other rules needed to derive Hart's vowel system from (18) will be presented directly, after a brief comment on the first of these rules (see (19) below).

Hart's dialect requires a Glide Insertion Rule which is obligatory before /ēw/ and optional before /ǣw/ since in the latter environment [y] appears only sporadically in Hart's transcriptions. Since the Glide Insertion Rule has certain terms in common with the Diphthongization Rule (8), we shall incorporate both into a single rule with two separate environments. As these environments are totally disjoint, there is actually no reason for ordering them as in (19) below. We use this order here only because it is the order in which the contemporary analogs of these rules appear in a grammar of modern English.

(19) GLIDE INSERTION (a), DIPHTHONGIZATION (b)

$$\phi \rightarrow \begin{bmatrix} -\text{voc} \\ -\text{cons} \\ \alpha\text{back} \end{bmatrix} \Big/ \left\{ \begin{array}{ll} \text{—} \begin{bmatrix} +\text{voc} \\ -\text{cons} \\ -\text{round} \\ \alpha\text{back} \end{bmatrix} \begin{bmatrix} -\text{voc} \\ -\text{cons} \\ -\alpha\text{back} \end{bmatrix} & \text{(a) } \textit{(optional in the context —— [+low])} \\ \begin{bmatrix} +\text{voc} \\ -\text{cons} \\ +\text{tense} \\ +\text{high} \\ \alpha\text{back} \end{bmatrix} \text{—} & \text{(b)} \end{array} \right\}$$

[12] The transcriptions *poët* and *voël*, "vowel," lack the expected indication of tenseness. The former is probably not relevant since it appears only once, and in the earliest of Hart's writings, where vowel tenseness was not consistently indicated. The transcription *voël* is more serious since it appears forty-seven times in various parts of Hart's works. Danielsson (1963, p. 164) believes that Hart's transcription can be explained on the grounds that to Hart "the diaresis was sufficient indication that the first vowel was long and the second short." Unfortunately this leaves unexplained the fact that Hart has the vowel [ɔ̄] here, a pronunciation which according to Danielsson is not attested in other sources. We should like to propose that Hart's *voël* stands for [vowel] i.e., for the pronunciation that is to be expected on historical grounds. The omission of the *w* in this position is not too surprising. This explanation, however, cannot be considered fully convincing either, since, as we have seen above, Hart did not always fail to observe the [w], as his transcription of the word *pouër*, "power," clearly indicates.

(20) VOWEL SHIFT (9)

$$\begin{bmatrix}\alpha\text{high}\\-\text{low}\end{bmatrix} \rightarrow [-\alpha\text{high}] \; / \; \begin{bmatrix}\text{———}\\+\text{tense}\\+\text{stress}\end{bmatrix}$$

(21) DIPHTHONG LAXING

$$[-\text{low}] \rightarrow [-\text{tense}] \; / \; \text{——}\begin{bmatrix}-\text{voc}\\-\text{cons}\end{bmatrix}$$

(22) VOWEL RAISING

$$\begin{bmatrix}\alpha\text{back}\\\alpha\text{round}\end{bmatrix} \rightarrow [-\text{low}]$$

Rule (22) states, in effect, that vowels agreeing in rounding and backness are nonlow. Note, incidentally, that (22) is not restricted to tense vowels; it applies to the lax vowels nonvacuously, as in *meant* ([ment]) from underlying /mǣn+t/.

As can be seen from Table 1 (p. 266), the rules that have been stated up to this point yield [yiw] as the reflex of underlying /ēw/, whereas Hart's transcription is *iu* (= [yu]). It is a relatively straightforward matter to add a rule which would insure the required phonetic output:

(23)
$$[+\text{high}] \rightarrow \begin{bmatrix}+\text{back}\\+\text{round}\end{bmatrix} \; / \; \text{——}\begin{bmatrix}-\text{voc}\\-\text{cons}\\+\text{back}\end{bmatrix}$$

To derive [yu], we must follow (23) by a rule deleting the postvocalic [w]. We shall not do so, however, since it seems rather dubious to us that Hart was able to distinguish [yuw] from [yu] when he failed in most of his writings to make the equally obvious distinction between [ōw] and [ō].

Rules applying to vowels characteristically come in blocks consisting of several rules. It is therefore possible to factor out the feature complex $\begin{bmatrix}+\text{voc}\\-\text{cons}\end{bmatrix}$ and count it only once in evaluating the complexity of the entire block. To reflect this fact, we have omitted these two features to the left of the arrow in the above rules.

The order in which the rules have been given can be justified only in part. We have already noted that there is no reason for ordering the two parts of rule (19). Most of the other rules are, however, fully ordered. The relative order of Diphthongization and Vowel Shift can be justified on the grounds that in the distinctive feature system the class [i, u] can be referred to by fewer features than the class [e, o]. Diphthong Laxing must obviously follow Diphthongization, but it must precede Vowel Raising since otherwise vowels will be laxed in the reflexes of the low diphthongs. Vowel Raising must also follow Vowel Shift since the vowels raised are not subject to Vowel Shift. Finally the $i \rightarrow u$ Rule (23) must follow Vowel Shift but need not be ordered after any later rules.

In Table 1 (p. 266) we illustrate the derivation of the phonetic reflexes from the postulated underlying representations.

TABLE 1. *The derivation of the phonetic reflexes from their underlying representations in Hart's dialect*[a]

	ī	ē	ǣ	ā	ō	ō	ū	ēw	ǣw	ǣy	āw	ōw	ōy	i	e	a	o	u
GLIDE INSERTION (19a)								yēw	(y)ǣw									
DIPHTHONGIZATION (19b)	īy						ūw											
VOWEL SHIFT (9)	ēy	ī				ū	ōw	yīw										
DIPHTHONG LAXING (21)	ey						ow	yiw										
VOWEL RAISING (22)			ē		ō				(y)ēw	ēy		ōw	ōy					
i → u (23)								yuw										
	ey	ī	ē	ā	ō	ū	ow	yuw	(y)ēw	ēy	āw	ōw	ōy	i	e	a	o	u

[a] Optional elements have been enclosed in parentheses.

3. *John Wallis (1653–1699)*

John Wallis' *Grammatica Linguae Anglicanae*, which he published in several editions between the years 1653 and 1699, was one of the most influential books on the English language. Wallis' phonetic writings have been reviewed by Lehnert (1936) and by Dobson (1957), who devotes an entire section to Wallis (pp. 218–43) and discusses many details of Wallis' pronunciation in various places in his book. The present discussion is based on these secondary sources as we have had only limited access to the original.

3.1. THE EVIDENCE

Wallis presents his vowels in a two-dimensional array, as shown in Table 2. The horizontal dimension, "aperture," reflects the degree of constriction with which a vowel is articulated and corresponds roughly to the traditional phonetician's "tongue height."

TABLE 2. *Wallis' vowel system*[a]

	Majori	Media	Minori
Gutterales	â, ŏ aperta long: *fall* short: *folly*	long: —— e foemininum short: *vertue*	ŭ, ò obscurum long: —— short: *turn come*
Palatinae	à exile long: *same* short: *Sam*	long: *seat* é masculinum short: *set*	ee, ĭ exile long: *feet* short: *fit*
Labiales	ô rotundum long: *those boat* short: ——	oo, û pingue long: *fool* short: *full*	ú exile long: *new* short: ——

[a] Adapted from Lehnert (1936).

The other dimension reflects the location in the mouth of the major constriction. Wallis recognizes three discrete values along each dimension so that his vowel scheme allows for nine distinct vowels. This number is further increased by Wallis' recognition that most vowels may appear in two lengths. We quote from Dobson's (1957) detailed summary of Wallis' description of his vowel system:

> Gutturals are formed in the throat or with the back part of the tongue and the palate; the breath is moderately compressed. With the major opening is formed a vowel which when long is the German *â*; the French and others often use this sound in pronouncing *a*. We spell the long sound *au, aw*, and more rarely *a*, the short sound we spell *o*; thus *fall* and *folly*, between which there is no difference except in quantity. With the medium opening is formed French *e* feminine, which differs from *â* only in the jaws being more closed; it is heard in English only when *e* precedes *r*, thus *vertue*. With the minor opening is formed "obscure *ò* or *ŭ*," which is nearly the sound of French *eur* in *serviteur*, and is heard in English in *dull, turn, come, country*, etc. The palatal vowels are formed by the breath being moderately compressed between the palate and the middle of the tongue; since the middle of the tongue is raised, the vault of the palate resounds less than in the case of the gutturals. With the major opening is formed the English "*à* exile," which is either short (as in *bat*) or long (as in *bate*). With the medium opening is formed the French *é* masculine; in English this sound is represented by *e*, and also (when long) by *ea* and occasionally *ei*. With the minor opening is formed the vowel *i*; in English it is spelt *ee* when long, or (less frequently) *ie* or even *ea*. The labials are formed in the lips, which are gathered into a round shape, with the breath moderately compressed there. With the major opening is formed round *ô* ("*ô* rotundum"), which some people use for Greek *ω*; with it are pronounced French *au* and English long *o* and *oa*. With the medium opening is formed German "*û* pingue," which is spelt *ou* in French, *w* in Welsh, and *oo* in English. With the minor opening is formed "*ú* exile," which is used in French and in English . . . Of these nine vowels two, "ŭ obscurum" and "e foemininum," are "seldom" long, while two, "ô rotundum" and "ú exile," are "seldom" short, "at least amongst us"; the rest are both long and short (pp. 225–26).

From this description we conclude that Wallis' palatal series contained the vowels [æ], [e], [i].

The labial series apparently contained the mid vowel [o] and the high vowel [u]. The third vowel in that series seems to be [ü], i.e., the fronted counterpart of [u]. However, other statements of Wallis' make it appear that he was not able to distinguish this vowel from the diphthong [iw].

The vowels of Wallis' gutteral series present more serious difficulties. It is probable that the most open of these sounds is [ə], but the value of *ŭ* or *ò obscurum* and of *e foemininum* cannot be directly determined. We shall follow Dobson and other scholars who identified *ŭ* or *ò obscurum* with its present-day reflex [ʌ], a vowel that is nonround, back, nonhigh, nonlow, and nontense. We have been unable to determine what sound Wallis meant by *e foemininum*. It seems reasonably clear that the sound was nonround and nontense; but the phonetic description given by Wallis and the discussions in secondary sources have not enabled us to determine its other features. Wallis finds the *e foemininum* in two environments only—before [r] and in the diphthongal reflex of tense /ī/; in the diphthongal reflex of tense /ū/, he observes *ò obscurum*. This distinction is not noted by

Wallis' contemporaries.[13] A parallel contrast in the vowel of the diphthongs is noted by Batchelor (see Section 5 of this chapter) a century and a half after Wallis. But Batchelor clearly has [ʌy] (i.e., Wallis' *ò obscurum*) in the reflex of tense /ī/, and [ɔw] (Wallis' *â*) as the reflex of tense /ū/. We therefore adopt a conservative position and treat *e foemininum* as a distinct sound in Wallis' speech whose precise phonetic value we are unable to determine (see pp. 272–73). We will represent it by the noncommittal symbol ɸ.

According to Wallis, diphthongs "consist of 'preposed' vowels and either of the consonants *y* and *w*" (Dobson, 1957, p. 233). In the reflexes of tense /ī/ and /ū/, the preposed vowels are, as already noted, *e foemininum* and *ò obscurum*, respectively. The diphthongs "*oi* and *ou* are said to have two pronunciations: one begins with *ŏ apertum* . . . the other with *ò obscurum*" (*ibid.*) These two diphthongs are therefore actualized either as [ɔy] and [ɔw] or as [ʌy] and [ʌw]. In the latter pronunciation, the reflex of the diphthong /ōw/ merges with that of the tense vowel /ū/; the reflex of the diphthong /ōy/, however, remains distinct from that of the tense vowel /ī/. Both Lehnert and Dobson attempt to connect the two pronunciations of /ōy/ with different historical antecedents ([ōy] versus [uy]). In view of the fact that the same alternation occurs in the reflexes of /ōw/, where only a single historical source can be postulated, and in view of the general lability of this distinction in English (see Jespersen, 1909, p. 100), the relatively few (three or four) examples that are cited by Lehnert and Dobson in support of the existence of this distinction do not appear convincing to us. It must be noted, finally, that Wallis also knew of the pronunciation of /ōw/ as the monophthong *ô rotundum* [ō]; "sed et haec omnia ab aliis efferuntur simpliciter per ô rotundum, acsi scripta essent *sole*, *sold*, *sno*, etc." (Lehnert, 1936, p. 126).

The reflex of the diphthong /āw/ in Wallis is regularly the long monophthong represented by the letter *â aperta*, which we have identified above with tense [ɔ̄].

The reflex of the diphthong /ǣy/ is described by Wallis as composed "ex à Anglico (hoc est, exili) correpto, et y" (Lehnert, 1936, p. 112); this would imply the pronunciation [æy], with a lax vowel. Wallis makes no reference to the well-attested contemporary pronunciation of the diphthong as the monophthong [ɛ̄].

Like Hart, Wallis distinguishes the reflex of the ME diphthong /ǣw/ from that of ME /ēw/. The former is described by Wallis as being composed of "é clarum et *w*"; whereas the latter is "sonus quasi compositus ex *ĭ* et *w*," which is the pronunciation that shall be assumed here as basic for Wallis. In Hart's dialect, it will be recalled, the reflex of ME /ēw/ was [yuw] and was kept distinct everywhere from the reflex of ME /ǣw/. Wallis notes frequent coalescences of these two diphthongs:

> quidam tamen paulo acutius efferunt acsi scribantur *niewter*, *fiew*, *bieuty*, vel *niwter*, *fiw*, *biwty*; praesertim in vocibus *new* novus, *knew* sciebam, *snew* ningebat. At prior pronunciatio rectior est (Dobson, 1957, p. 239).

3.2. WALLIS' PATTERN

The main phonetic reflexes of the ME vowels and diphthongs in Wallis' speech are given in (24). (Secondary and optional variants have been enclosed in parentheses. The symbol ɸ represents Wallis' *e foemininum*.)

[13] In his *Defence of the Royal Society*, Wallis commented on his disagreement with Wilkins concerning this issue: "In some others, he continued to differ from me, as in the French feminine *e* and the English short *u*. Which letters he accounts to be the same: but I take to be different, (that of *u* being a broader sound than the other;) differing as *e* and *u* in our English pronunciation of *fer*, *fur*; *iter*, *itur*; *terris*, *turris*; *terter*, *turtur*; *perperam*, *purpuram*, etc." (Quoted in McIntosh, 1956, p. 172).

(24)

ME	ī	ē	ǣ	ā	ɔ̄	ō	ū
	↓	↓	↓	↓	↓	↓	↓
Wallis	ɐy	ī	ē	ǣ	ō	ū	ʌw

ME	ēw			ǣw			ǣy	āw		ɔ̄w		ɔ̄y	
	↓	↙	↓	↘			↓	↓	↙	↓	↘	↙	↘
Wallis	iw	(iw)	ēw	(yēw)			æy	ɔ̄	ɔw	(ʌw)	(ō)	ɔy	(ʌy)

ME	i	e	a	o	u	
	↓	↓	↓	↓	↙	↘
Wallis	i	e	æ	ɔ	ʌ	u

With the exception of the reflexes of ME lax /u/, which basically paralleled those of the standard dialect (see Table 2 under *û pingue* and Lehnert (1936, pp. 107–108)), the number of phonetically distinct entities in Wallis' speech is the same as in ME, for all coalescences that have taken place are optional pronunciations. Since Wallis' dialect was subject to the Laxing and Tensing Rules (3) and (4), we shall assume that its underlying system of representation was identical with that postulated for ME and, thus, with Hart's underlying system as well. The reflexes of lax /u/ will be accounted for below by special rules.

An important difference that emerges from a comparison of Hart's dialect with that of Wallis (cf. (16) and (24)) is that there are many fewer instances of tense or lax [o] in Wallis' speech than in Hart's. Thus, the normal reflex of the lax monophthong /o/ is [o] for Hart, but [ɔ] for Wallis; the reflex of tense /ū/ is [ow] for Hart, but [ʌw] for Wallis. To account for the fact that tense /ū/ is actualized as [ʌw] rather than as [ow], we assume as a first approximation that after Vowel Shift and Diphthong Laxing, but before Vowel Raising, Wallis' grammar contained the Unrounding Rule (25):

(25)

$$\begin{bmatrix} +\text{back} \\ -\text{tense} \\ -\text{low} \\ -\text{high} \end{bmatrix} \rightarrow [-\text{round}]$$

This rule unrounds the vowel in the diphthongal reflex of tense /ū/, resulting in [ʌw].

This diphthong is not the only instance of [ʌ] in Wallis' speech; the sound also appears as a reflex of lax /u/ in words such as *dull, country*, that is, in words which essentially coincide with those in which [ʌ] appears in modern English.[14] Since the Unrounding Rule (25) is independently motivated for Wallis' speech, it is natural to attempt to take advantage of this rule in accounting for the appearance of [ʌ] as a reflex of lax /u/. In other words, one would naturally wish to connect the appearance of [ʌ] in these two environments, rather than regard them, as is usual in the handbooks, as two unrelated phenomena. But if this is to be done, rule (25) must be preceded by some rule which lowers the appropriate lax /u/ to [o]. The machinery for achieving this already exists, in part, for the Vowel Shift Rule, which is known to be in Wallis' grammar, lowers tense /ū/. All we need to do, then, is to

[14] Wallis is one of the earliest orthoepists to note the appearance of this reflex of lax /u/. To the best of our knowledge, this reflex is first attested by an orthoepist about a decade before Wallis, in the works of R. Hodges.

extend this rule so that it will apply to lax /u/ as well:[15]

(26)
$$\begin{bmatrix}\alpha\text{high}\\-\text{low}\\+\text{stress}\end{bmatrix} \rightarrow [-\alpha\text{high}] \Big/ \left\{ \begin{bmatrix}\_\_\_\_\\-\text{tense}\\+\text{round}\end{bmatrix} \right. \quad \text{(a)}$$
$$\left. \begin{bmatrix}\_\_\_\_\\+\text{tense}\end{bmatrix} \right\} \quad \text{(b)}$$

It must be noted that the order in which the two parts of the Vowel Shift Rule are presented here is quite arbitrary, since the two environments are totally disjoint. The choice of the feature "round" in part (a), on the other hand, is not arbitrary, though it may appear so at this stage of our discussion since lax /u/ could also, at this point in the grammar, be uniquely identified by the features $\begin{bmatrix}+\text{back}\\-\text{tense}\\-\text{low}\end{bmatrix}$.

The rules given up to this point would not allow any lax [u] in Wallis' speech. Lax [u] does occur, however, in many of the same environments as in modern English. Wallis' grammar must therefore be assumed to contain a rule exempting certain cases of /u/ from Vowel Shift. Since we have formulated the Vowel Shift Rule so that it applies only to round lax vowels, it would be blocked if /u/ were unrounded in the relevant environments, that is, if the grammar contained a rule such as (27):

(27)
$$\begin{bmatrix}+\text{back}\\-\text{tense}\\+\text{high}\end{bmatrix} \rightarrow [-\text{round}] \quad \text{in certain contexts}$$

However, rule (27) turns lax /u/ into [i], which is not attested in Wallis' speech. Thus we now need a rule to undo the effects of (27) and reround precisely those instances of /u/ which rule (27) unrounded. This is hardly an attractive solution and indicates that the proposed rules may stand in need of revision.

To remedy these inadequacies, we suggest that rule (27) be retained as a readjustment rule but that the Unrounding Rule (25) be replaced by (28):

(28) ROUNDING ADJUSTMENT (VERSION 1)
$$\begin{bmatrix}+\text{back}\\\alpha\text{round}\end{bmatrix} \rightarrow [-\alpha\text{round}] \Big/ \begin{bmatrix}\_\_\_\_\\-\text{tense}\\-\text{low}\end{bmatrix}$$

Rule (28) unrounds [o] while simultaneously rounding [i]. We observe that (28) requires exactly the same number of features as (25). This proposal gains additional plausibility from the fact that Rounding Adjustment accounts for another peculiarity of Wallis' speech, as we shall now see.

A further difference between the speech of Wallis and that of Hart is in the actualization of the diphthong /āw/. Whereas for Hart this diphthong is [āw], for Wallis the reflex

[15] The lowering of /u/ without accompanying unrounding is attested in a large area of England. Wright (1905) represents this reflex by the letter *ù* and characterizes it (§15) as "a sound formed with the lips more open than for *u*. Acoustically it somewhat resembles an *o* sound." According to Wright, it is found in the counties of Antrim, Lancashire, Isle of Man, Cheshire, Flint, Denbigh, Staffordshire, Derby, Nottingham, Leicester, Northampton, Warwick, Worcester, Shropshire, Hereford, Gloucester, and Oxford (§98). This indicates that the addition of environment (a) to the Vowel Shift Rule (26) is not an ad hoc device invented solely to account for the facts under discussion here.

of the diphthong is [ɔ̄]. It is readily seen that in order to get [ɔ̄] from /āw/, we require rules of monophthongization and rounding adjustment. The latter must apply here to a vowel that is both tense and low, whereas in (28) it applied to vowels that were nontense and nonlow. We therefore extend Rounding Adjustment to apply in both cases:

(29) ROUNDING ADJUSTMENT (VERSION 2)

$$\begin{bmatrix} +\text{back} \\ \alpha\text{round} \end{bmatrix} \rightarrow [-\alpha\text{round}] \; / \; \begin{bmatrix} \text{———} \\ \beta\text{tense} \\ \beta\text{low} \end{bmatrix}$$

Rule (29) now applies to back vowels that agree in tenseness and lowness: lax [u], [i̱], [o], [ʌ] and tense [ā], [ɔ̄]. Its applicability to [u] and [ʌ] has no effect, however, since there are no such segments at this point in the grammar. (See Table 3, p. 274.)

It is necessary to insure that Rounding Adjustment does not apply to the reflexes of the diphthongs /ɔ̄y/ and /ɔ̄w/, for these diphthongs are actualized, in the dialect that we regard as basic for Wallis, with the lax round [ɔ]. (The secondary dialect is discussed below.) Rounding Adjustment will not apply to these diphthongs if the Diphthong Laxing Rule is allowed to precede Rounding Adjustment. In this case, however, it is necessary to exempt /āw/ from Diphthong Laxing, for the /ā/ of this diphthong is both tense and subject to Rounding Adjustment. We achieve this by imposing on Diphthong Laxing the condition that it applies only to vowels that agree in backness and rounding. We observe that this restriction appeared in Hart's dialect, where the Vowel Raising Rule (22) had to be similarly constrained. Furthermore, the Vowel Raising Rule must figure in Wallis' dialect in precisely the same contexts as in that of Hart. Since Vowel Raising may immediately follow Diphthong Laxing, the condition that these two rules require need not be stated twice but can be factored out by the usual notational conventions. The Vowel Raising Rule, however, must be slightly more constrained for Wallis than for Hart, since it must specifically exempt lax [ɔ]. The two rules will therefore be coalesced as follows:

(30)

$$\begin{bmatrix} \alpha\text{back} \\ \alpha\text{round} \end{bmatrix} \rightarrow \left\{ \begin{array}{ll} [-\text{tense}] \; / \; \text{——} \begin{bmatrix} -\text{voc} \\ -\text{cons} \end{bmatrix} & \text{(a)} \\ [-\text{low}] \; / \; \begin{bmatrix} \text{———} \\ +\text{tense} \end{bmatrix} & \text{(b)} \end{array} \right.$$

Rule (30a) is Wallis' Diphthong Laxing Rule, and (30b) is Wallis' Vowel Raising Rule.

In Wallis' grammar the possibility of coalescing Diphthong Laxing and Vowel Raising provides a justification for placing Diphthong Laxing after Vowel Shift and directly before Vowel Raising.

We note that a further modification is needed to account fully for the facts. In the dialect that Wallis considers basic, the diphthong /ǣw/ is actualized as [ē̱w], with a tense vowel that is also raised. In other words, in this dialect Diphthong Laxing does not apply to the diphthong /ǣw/, and, as opposed to Hart's dialect, this is the only diphthong to which it does not apply. To block Diphthong Laxing here, we assume that Wallis' grammar had a special readjustment rule which exempted /ǣw/ from the Diphthong Laxing Rule. But once Diphthong Laxing is blocked here, Wallis' Vowel Raising Rule automatically applies. This result is a further justification for ordering Vowel Raising after Diphthong Laxing.

This order does not hold in the second dialect described by Wallis—the one in which /ɔ̄w/ and /ɔ̄y/ are actualized as [ʌw] and [ʌy], respectively. Here it is necessary to invert the

order of Diphthong Laxing and Vowel Raising. If Vowel Raising applies before Diphthong Laxing, the two diphthongs will be turned, respectively, into [ow] and [oy]. They will then be subject to Rounding Adjustment, which will result in the correct output. In this case, however, an additional readjustment rule will be required in order to block Vowel Raising in the diphthong /ǣy/, which in Wallis' dialect is actualized as [æy] rather than as [ey].[16]

To obtain the secondary pronunciation of /ǣw/, which Wallis characterizes as "compositum ex *i* et *w*," we shall assume that Wallis had a special readjustment rule that raised /ǣw/ to [ē w]. The subsequent derivation of this diphthong then proceeds exactly like that of the diphthong /ē w/.

Two facts must still be accounted for. In Wallis' speech tense and lax /a/ are fronted in monophthongs, whereas in the diphthong /ā w/ the vowel is rounded by the Rounding Adjustment Rule. Moreover, the glide of the diphthong is not present in the output. To account for these facts, we postulate the two rules (31) and (32):

(31) FRONTING RULE

$$\begin{bmatrix} +\text{low} \\ -\text{round} \end{bmatrix} \rightarrow [-\text{back}] \; / \; \text{——} \begin{Bmatrix} \# \\ [+\text{cons}] \\ [+\text{voc}] \end{Bmatrix} \begin{matrix} \text{(a)} \\ \text{(b)} \\ \text{(c)} \end{matrix}$$

Rule (31) applies only in monophthongs.

(32) MONOPHTHONGIZATION

$$\begin{bmatrix} -\text{voc} \\ -\text{cons} \end{bmatrix} \rightarrow \phi \; / \begin{bmatrix} +\text{voc} \\ -\text{cons} \\ +\text{low} \\ +\text{tense} \end{bmatrix} \text{——}$$

Rule (32) deletes the glide after [ā].

The preceding accounts for the major features of Wallis' speech except for *e foemininum*. There is no difficulty in principle in accounting for *e foemininum* since its antecedents, [ey] and nonback vowel before /r/, remain distinct. Once it is determined what *e foemininum* represents phonetically, it is a trivial matter to add a rule assigning the appropriate

[16] It has been proposed by Kiparsky (1965) that differences in naturalness (markedness—see Chapter Nine) are to be recognized also with regard to the order in which a pair of rules appears in a grammar. Given a pair of rules such as

(I) $[\alpha F] \rightarrow X$ in the context Z

(II) $Y \rightarrow [-\alpha F]$ in the context W

where Z is not distinct from W, X is not distinct from Y, Kiparsky suggests that the order (I), (II) be regarded as less marked (more natural) than the order (II), (I) since in the former order the two rules are utilized more fully than in the latter: if the rules are applied in the order (II), (I), any part of the string subject to (II) is no longer subject to (I).

Kiparsky presents evidence in support of the view that languages tend to change from a more marked to a less marked order of rules. The two alternative treatments of the diphthongs /ō y/ and /ō w/ reported by Wallis exemplify such a change. In the first dialect Diphthong Laxing precedes Vowel Raising. Since Vowel Raising applies only to tense vowels, any vowel subject to Diphthong Laxing is automatically excluded from Vowel Raising. Similar exclusions do not apply if the order is reversed, as it is in the second dialect described by Wallis. The latter dialect exhibits, therefore, a less marked order of rules than the former. It is significant that the former dialect is also the more conservative, more archaic form of speech favored by Wallis.

features to the segments in question. In a parallel ad hoc fashion, it is possible to account for the alternative pronunciation of the diphthong /ōw/ as [ō]. We shall not do this, since it is clear that nothing can be learned from such rules.

To summarize the above discussion, we list the rules that have been postulated for Wallis' dialect. (Note the *o*-Lowering Rule (33IV) which is presented here without discussion since the need for such a rule is self-evident.) We shall give the rules only for the basic dialect reported by Wallis and omit the modifications required to obtain the other pronunciations.

(33) WALLIS' DIALECT

(I) SPECIAL READJUSTMENT RULES
- (a) Unround lax /u/ after labials and in certain other environments (27).
- (b) Mark /ǣw/ as exempt from Diphthong Laxing (30a).

(II) LAXING (3)

(III) TENSING (4)

(IV) *o*-LOWERING

$$o \rightarrow ɔ$$

(V) GLIDE INSERTION (a), DIPHTHONGIZATION (b) (19)

$$\phi \rightarrow \begin{bmatrix} -\text{voc} \\ -\text{cons} \\ \alpha\text{back} \end{bmatrix} \Big/ \left\{ \begin{array}{ll} \_\_ \begin{bmatrix} +\text{voc} \\ -\text{cons} \\ -\text{round} \\ \alpha\text{back} \\ +\text{low} \end{bmatrix} \begin{bmatrix} -\text{voc} \\ -\text{cons} \\ -\alpha\text{back} \end{bmatrix} & \text{(a) } (\textit{optional}) \\ \begin{bmatrix} +\text{voc} \\ -\text{cons} \\ +\text{tense} \\ +\text{high} \\ \alpha\text{back} \end{bmatrix} \_\_ & \text{(b)} \end{array} \right\}$$

(VI) VOWEL SHIFT (26)

$$\begin{bmatrix} \alpha\text{high} \\ -\text{low} \\ +\text{stress} \end{bmatrix} \rightarrow [-\alpha\text{high}] \Big/ \left\{ \begin{array}{ll} \begin{bmatrix} \_\_\_\_ \\ -\text{tense} \\ +\text{round} \end{bmatrix} & \text{(a)} \\ \begin{bmatrix} \_\_\_\_ \\ +\text{tense} \end{bmatrix} & \text{(b)} \end{array} \right.$$

(VII) DIPHTHONG LAXING (a), VOWEL RAISING (b) (30)

$$\begin{bmatrix} \alpha\text{back} \\ \alpha\text{round} \end{bmatrix} \rightarrow \left\{ \begin{array}{ll} [-\text{tense}] \ / \ \_\_ \begin{bmatrix} -\text{voc} \\ -\text{cons} \end{bmatrix} & \text{(a)} \\ [-\text{low}] \ / \ \begin{bmatrix} \_\_\_\_ \\ +\text{tense} \end{bmatrix} & \text{(b)} \end{array} \right.$$

(VIII) FRONTING (31)

$$\begin{bmatrix} +\text{low} \\ -\text{round} \end{bmatrix} \rightarrow [-\text{back}] \ / \ \_\_ \left\{ \begin{array}{ll} \# & \text{(a)} \\ [+\text{cons}] & \text{(b)} \\ [+\text{voc}] & \text{(c)} \end{array} \right.$$

(IX) MONOPHTHONGIZATION (32)

$$\begin{bmatrix} -\text{voc} \\ -\text{cons} \end{bmatrix} \rightarrow \phi \; / \; \begin{bmatrix} +\text{voc} \\ -\text{cons} \\ +\text{low} \\ +\text{tense} \end{bmatrix} \_\_$$

(X) ROUNDING ADJUSTMENT (29)

$$\begin{bmatrix} +\text{back} \\ \alpha\text{round} \end{bmatrix} \rightarrow [-\alpha\text{round}] \; / \; \begin{bmatrix} \overline{\quad\quad} \\ \beta\text{tense} \\ \beta\text{low} \end{bmatrix}$$

TABLE 3. *The derivation of the phonetic reflexes from their underlying representations in Wallis' dialect*[a]

	ī	ē	ǣ	ā	ō	ō	ū	ēw	ǣw*	ǣy	āw	ōw	ōy	i	e	a	o	u (u / ɨ)	
o-LOWERING (33IV)																	ɔ		
GLIDE INSERTION (19a)									(y)ǣw										
DIPHTHONGIZATION (19b)	īy						ūw												
VOWEL SHIFT (26)	ēy	ī				ū	ōw	īw										o	
DIPHTHONG LAXING (30a)	ey						ow	iw	—	æy		ɔw	ɔy						
VOWEL RAISING (30b)			ē		ō				(y)ēw										
FRONTING (31)				ǣ												æ			
MONOPHTHONGIZATION (32)											ā								
ROUNDING ADJUSTMENT (29)							ʌw				ō							ʌ	u
	ey ↓ ɐ̄y	ī	ē	ǣ	ō	ū	ʌw	iw	(y)ēw	æy	ō	ɔw	ɔy	i	e	æ	ɔ	ʌ	u

[a] Optional elements have been enclosed in parentheses. The rule accounting for *e foemininum* is not included. The starred item is an exception to Diphthong Laxing. The effects of (33Ia) are shown in the last two columns of the top row.

Comparing the dialects of Hart and Wallis, we observe that with certain unsystematic exceptions the two dialects have underlying systems that are essentially identical with that of ME and with each other. The differences observed between the dialects would therefore seem to be the result of the addition of rules. This fact is further brought out by the parallel listing of the respective sets of rules shown in (34) (in which rules not identical in the two dialects are starred):

(34)

HART	WALLIS
	u → i (27)
	o-Lowering (33IV)
* Glide Insertion (19a)	* Glide Insertion (19a)
Diphthongization (19b)	Diphthongization (19b)
* Vowel Shift (9)	* Vowel Shift (26)
* Diphthong Laxing (21)	* Diphthong Laxing (30a)
* Vowel Raising (22)	* Vowel Raising (30b)
i → u (23)	
	Fronting (31)
	Monophthongization (32)
	Rounding Adjustment (29)

The differences are of two kinds. Wallis' dialect is subject to certain rules that are not present in Hart's speech; moreover, several of Hart's rules appear in Wallis' dialect in somewhat modified form. In particular, Wallis' speech is subject to Rounding Adjustment (29), which is absent in Hart, and in Wallis' dialect the Vowel Shift is generalized to include the lax vowel /u/. It seems worth repeating here that the major phonetic developments in Wallis' speech—the change /u/ → [ʌ] and the modifications in the pronunciation of certain of the diphthongs—have been shown to be connected: they are largely due to the addition of Rounding Adjustment to Wallis' grammar.

It can be observed from (34) that the development up to this point does not show any discontinuities. Discontinuities due to restructuring are found in the next dialect to be examined—that of Wallis' younger contemporary Christopher Cooper.

4. *Christopher Cooper (1687)*

A comparison of the speech of John Wallis with that of Cooper, who was a younger contemporary of Wallis', reveals considerable differences. It has often been remarked that Wallis represented a strongly archaistic and conservative tendency. Cooper's speech would therefore seem to be much closer to the normal speech of the educated classes of the time. In our discussion of his dialect, we base ourselves on Cooper's book *The English Teacher* (1687), which is now available in the convenient reprint prepared by Sundby (1954), from which we have drawn all our citations unless otherwise indicated. We have consulted J. D. Jones' (1912) reprint of Cooper's Latin book *Grammatica Linguae Anglicanae* (1685) and have profited from the discussions of Cooper's work in Dobson (1957) and in Zachrisson (1913).

4.1. THE EVIDENCE

In Cooper's phonetic system a distinction is made between vowel quality or "essence" and vowel quantity or "measure of time. Every one of the vowels is pronounced short and long in their proper sound, except *u* guttural, whereby the number is doubled not in Essence, but only in the measure of time" (p. 9).

Cooper recognizes the following eight vowel qualities.

a lingual is formed "by the middle of the Tongue a little rais'd to the hollow of the Pallate. In *these can, pass by, a* is short; in *cast, past* for *passed*, it is long" (p. 4).

This suggests that *a lingual* is a nonback low vowel, [æ]. It is the reflex of ME lax /a/ and is apparently tensed before a voiceless continuant followed by [t].

e lingual "is form'd by the Tongue more rais'd toward the end and extended than in *a* foregoing; whereby the passage for the breath between the Tongue and the Pallate is made narrower, and the sound more acute; as in *ken, men* . . . The true lengthning of this sound is written by *a* and is falsly called *a* long; as in *cane, wane*; and before *ge* as in *age*; and *nge*, as in *strange*; but in all other words (unless I mistake) where *e* silent is added to the end of a syllable, *u* guttural . . . is put after *a*; as in *name* as if it was writ *na-um*, a disyllable. This sound, when it is purely pronounced, is written *ai* or *ay* as *pain, day*; which are commonly thus sounded in almost all words; so *ey* in *convey, obey, purvey, survey, they, trey, whey*; sometimes but rarely *ea, pearl.*

It is short in { *Sell* / *Sent* / *Tell* / *Tent* } And long in { *Sail* / *Saint* / *Jail* / *Taint* }

but in *sale, tale* it is sounded as if it was writ *sa-ul, ta-ul* (as before)" (p. 5).

This phonetic description argues that *e lingual* has the phonetic value of tense and lax [e]. Its lax variant represents ME lax /e/, and the tense variant, ME /ǣy/. ME tense /ā/, on the other hand, seems in Cooper's dialect to be reflected by a diphthong with a centering glide, [ēʌ], if the quoted passage is taken at face value. There is no particular difficulty in incorporating this fact into a grammar by setting up two entities in the underlying representations. It appears, however, that the insertion of a centering glide after nonhigh tense vowels is a rather common feature of many dialects. Cooper notes a centering glide (p. 16) as following [ɔ] in a list of fifteen learned words, but remarks that "those that speak more carelessly, sound as ɑ [= [ɔ], NC/MH]; in all others we pronounce *au* and *aw* as ɑ onely." We shall assume, therefore, that this is an instance of dialect mixture and shall take as basic the variant without the centering glide.

i lingual is formed "by the Tongue nearer to the end, higher raised and more expanded, whereby the passage for the breath is rendered narrower, and the sound more subtle than in *ken* and *cane*; as in *win, priviledge* . . ." (p. 6).

This is the lax vowel [i]. According to Cooper the tense variant of this sound is found in words such as *wean* (see, e.g., pp. 7 and 13). However, this is not to be taken as proof that Cooper had four high [i] sounds, as we shall see.

ee lingual is formed "by the end of the Tongue fixed to the lower Teeth, both expanded and raised to the highest degree, whereby the passage of the Air is most of all straightened, and the sound made the closest of all vowels, and coming nearest to the nature of consonants; as in *feet, feed*; and therefore there is the least difference between the shortening or lengthening thereof because there is so little space between the Tongue and the Pallate in forming it" (p. 6).

This sound is evidently the tense, high, nonback [ī]. *ee lingual* represents the reflex of ME tense /ē/ in Cooper's speech, and the differences in length noted are, of course, due to the presence or absence of a following voiceless consonant. Thus, Cooper had correctly observed length distinction between the vowels in *feed* and *feet*. He had also observed that there were distinctions in quality (as well as in length) between the vowels in *win* and *feet* and had decided quite naturally that there must therefore also be a long vowel corresponding to the vowel in *win*. He assumed that this vowel was the vowel in *wean*, i.e., the reflex

of ME /ǣ/. However, not all reflexes of ME /ǣ/ are treated by Cooper in this fashion; before [r] they are all said to be pronounced with *ee lingual*, i.e., [ī]. The simplest explanation for this choice is to assume that Cooper pronounced the vowel [ī] here but knew, of course, that in the writings of his predecessors the reflex of ME tense /ǣ/ did not coalesce with that of ME tense /ē/. He may therefore, as suggested by Zachrisson (1913):

> have felt obliged to keep up the old distinction . . . even if this distinction merely consisted in giving the same sound two different names. This assumption may help us to explain the peculiar way in which Cooper treated *ę*, *ę* in front of *r*. Here neither the spelling nor earlier orthopoetical works gave any clue to the etymology. Hence Cooper confused *ę* and *ę* in this position, by placing *all* words in which he pronounced *ea* in front of *r* as *ī* under *ee lingualis* (p. 204).

We shall assume, therefore, that in Cooper's speech ME /ǣ/ and /ē/ coalesced into [ī], whereas ME lax /i/ remained a lax, high, nonback vowel.

o labial is formed "by the lips a little contracted, while the breath is emitted circular; as in *hope*. Thus the *English* alwayes pronounce this when long; (except in a few, where it is sounded *oo*, as *move*, or *ou* labial before *l*, as *bold*) which some times they express by *oa*, as *Coach*; it is seldom short in its own sound, unless in a few, which begin with a labial consonant, as after *w* in *wolf*, *wonder*, and such like, . . . and in the syllable *wor-*; more I do not remember. In some *u* is pronounced thus, where the foregoing consonant is labial; as *pull*, *full*, not because this is the truest, but the easiest pronunciation: And *oo* in *good*, *hood*, *stood*, *wood*" (pp. 7–8).

oo labial is formed "by the lips very much contracted; as *book*, *boot*; there is very little difference between the short and long sound, for the reason aforesaid under *ee*. We always pronounce it thus, except in those words which are excepted in the foregoing and following Sections" (p. 8).

o guttural is formed "by the root of the Tongue moved to the inner part of the Pallat, while the middle of the Tongue is depressed, which causes the greatest space between the fore part of the Tongue and Pallat; and there it hath the most open and full sound of all the vowels, as in *loss*" (p. 8).

From the foregoing it would appear that *o guttural* represents [ɔ]; *o labial*, [o]; and *oo labial*, [u]. However, the fact that, just as in the nonback vowels, the high lax vowel differed in quality rather obviously from the high tense vowel led Cooper to pair the former not with the high tense [ū] as in *boot* but rather with the nonhigh nonlow tense [ō] as in *hope*. In the back vowels, however, the situation is somewhat simpler than in the nonback vowels since in Cooper's speech there was no back counterpart to lax [e].

In Cooper's speech, then, tense [ū] is the major reflex of ME tense /ō/; lax [u] represents ME lax /u/ after labials and ME tense /ō/ before velars and in certain morphemes. Cooper's tense [ō] mirrors ME low tense /ɔ̄/ and no lax [o] seems to be attested. The low tense [ɔ̄] is the reflex of the ME diphthong /āw/ (see p. 280) as well as of ME /ā/ in certain environments, e.g., before /l/, and of lax ME /o/ tensed before /f/, /θ/, /s/, +/t/; whereas the low lax [ɔ] is the reflex primarily of ME lax /o/.

The ME lax /u/ is represented in Cooper's speech in most environments by *u guttural*.

u guttural is formed "only in the throat, by the Larynx striking the Air, causing a naked murmur, which is the same with the groaning of a man that is sick or in pain; and which Infants also (before they are able to speak) first utter: And it is the principle, of which

all the other Vowels are made by the various fashionings of the breath . . . The *English* scarce ever pronounce this sound, when short, otherwise than in *nut*; (*as also in the Latine*) unless where the foregoing consonant is labial and shapes the lips to give it a fuller sound as in *pull*; between these there is very little, yet a specifical difference; such as is between the *English cup* and *French copy*; for the former sound is thinner, this latter fuller; that is formed onely by the Larynx in the Throat, this by the Lips contracted; therefore while *o* is formed by the Lips in a continued sound, if the Lips fall into an Oblong figure, *u* guttural is form'd" (p. 9).

In Cooper's description *u guttural* is thus the unrounded congener of lax [o], i.e., [ʌ].

ME tense /ī/ and /ū/ are represented in Cooper's speech by [ʌy] and [ʌw], respectively. "*u* in *cut* and *i* most easily make a diphthong, which we call *i* long; as *wine* (p. 15); "*u* guttural before the German *u*, that is the English *oo*, we always write *ou*; as in *out, about*" (p. 16).

The ME diphthong /ǣy/ is rarely actualized as [æy] or [ey]. "For the most part in common Discourse we speak *ai* as *a* simple in *cane*" (p. 15).

The ME diphthong /ɔ̄y/ is actualized as [ɔy]. "*o* in *loss, lost* set before *i* is pronounced in *joy, coy, coif*; which is thus sounded in almost all words" (p. 15).

The ME /ǣw/ and /ē w/ have both become [yu] in Cooper's speech (p. 16).

The ME /āw/ is actualized in careful discourse as [ɔw] (p. 16); in less careful speech, as [ɔ̄].

"Cooper makes no distinction between Me *ǭ* in *hope* and *ou* in *know*... Both had acquired the value [o:] in his pronunciation" (Sundby, 1954, p. XLIII).

4.2. COOPER'S PATTERN

In (35) we give the main phonetic reflexes of the ME vowels and diphthongs as they appear in Cooper's speech.

(35)

ME	ī	ē	ǣ	ā	ɔ̄	ō	ū
	↓	↓	↙	↓	↓	↓	↓
Cooper	ʌy	ī		ē	ō	ū	ʌw
				↑	↑		
ME	ēw	ǣw		ǣy	ɔ̄w	ɔ̄y	āw
	↓	↙				↓	↓
Cooper	yuw					ɔy	ɔ̄
ME	i	e	a	o	u		
	↓	↓	↓	↓	↙↘		
Cooper	i	e	æ	ɔ	ʌ	u	

It will be recalled that in the dialects of Hart and Wallis we found that the ME contrasts were essentially intact and only their phonetic actualizations had undergone changes. In Cooper's dialect, on the other hand, this is no longer the case; as can be seen in (35), quite a number of the ME contrasts have been eliminated. We shall first assume that these mergers have not affected the underlying representations and develop a set of rules consistent with this assumption. We shall then show that a simpler grammar can account for all the data and that in this simpler grammar fewer contrasting vowel types are required in the underlying representation. This fact, however, will not deprive the former grammar of all interest, for it will provide some insight into the historical evolution of

Cooper's dialect, which must, of course, have descended from a dialect having the contrasts found in ME, in Hart, and in Wallis.

Since Cooper's dialect, like all other dialects of modern English, was subject to the Laxing and Tensing Rules, we shall assume that it was also subject to Diphthongization and Vowel Shift in the form in which these appeared in Wallis' speech, i.e., (19b) and (26). As we have seen, Cooper showed the same reflexes ([u] and [ʌ]) of lax /u/ as Wallis. Moreover, like Wallis, Cooper actualizes tense /ū/ as [ʌw]. These facts indicate that Cooper's speech must be assumed to have been subject to Rounding Adjustment (29) as well as to the other rules connected with this phenomenon, such as the readjustment rule unrounding certain occurrences of lax /u/ and the rule lowering lax /o/.

A difference between Cooper's and Wallis' dialects concerns ME /ǣ/, which in Cooper's but not in Wallis' speech merges with tense /ē/, except in the diphthong /ǣy/. To account for this, we postulate a special æ-Raising Rule which applies before Vowel Shift.

(36) æ-RAISING

$$[-\text{back}] \rightarrow [-\text{low}] \;/\; \textit{except} \text{ ——y}$$

Since, like all dialects reviewed in this chapter, Cooper's speech was subject to the Laxing Rule (3), the æ-Raising Rule (36) was not restricted to tense vowels but applied to lax vowels as well.

There is a certain amount of evidence to show that a rule much like (36) was optional in sixteenth and seventeenth century English. In the rhymes of the poets of the period, we find vacillations that could readily be accounted for if it were assumed that (36) was optional for them. Thus Wyld (1927) cites the following rhymes pointing to the absence of rule (36):

> Surrey, *please–days*;... Spenser, *uncleane–mayntayne*; Drayton, *dreams–Thames, mead–braid, maids–beads*;... Cowley, *play–sea*; Dryden, *dream–shame, obey–sea, seas–sways*; Pope, *weak–take, eat–gate, eat–state, speak–take, great–state, shade–dead*, etc. (pp. 171–72).

In the same period he also finds the following rhymes pointing to the presence of (36):

> Surrey, *reach–beseech*,... Spenser, *seas–these, streame–seeme, uncleane–weene*;... Waller, *sea–she–be*;... Cowley, *sea–be–he–thee*; Dryden, *sea–free, meat–seat, bread–feed*;... Pope, *seat–fleet, queens–means, sea–flee*...

We now observe that Cooper's reflex of /ī/ is [ʌy]. It will be recalled that in our discussion of Wallis' dialect we provided rules that yielded the reflex [ey] (see Table 3, p. 274). In order to obtain the correct result for Cooper, we shall modify Wallis' Diphthong Laxing Rule (30a) as follows:

(37) DIPHTHONG LAXING

$$\begin{bmatrix}\alpha\text{back}\\ \alpha\text{round}\end{bmatrix} \rightarrow \begin{bmatrix}-\text{tense}\\ +\text{back}\\ -\beta\text{round}\end{bmatrix} / \begin{bmatrix}\text{——}\\ \beta\text{high}\end{bmatrix}\begin{bmatrix}-\text{voc}\\ -\text{cons}\end{bmatrix}$$

This rule will affect precisely the same diphthongs as before, but in addition to laxing their vowels, it will make the vowels [+back] and bring about dissimilation between the features "round" and "high."

As now formulated rule (37) would affect the diphthongs [ēy], [ōw], [yīw], [ǣy], [ōw], [ōy] (see Table 3) and convert them into [oy], [ow], [yɨw], [əy], [əw], [əy], respectively. The first three of these would then be subject to Rounding Adjustment, which would

yield the phonetically correct reflexes. The last three must be subject to additional rules, since the reflex of /ǣy/ never merges with that of /ɔ̄y/, but is monophthongized instead. A further difficulty becomes apparent when we recall that the reflex of /ɔ̄w/, like that of /ǣy/, is monophthongized rather than laxed. These difficulties disappear if we assume that in Cooper's dialect Monophthongization preceded Diphthong Laxing. But if Monophthongization is to precede Diphthong Laxing, it cannot apply to all low diphthongs as in Wallis' dialect (see (32)), but rather must apply to glides that agree with the preceding vowel in the coefficient of the feature "back," that is, it must apply to [ǣy], [ā̄w], [ɔ̄w].

(38) MONOPHTHONGIZATION

$$\begin{bmatrix} -\text{voc} \\ -\text{cons} \\ \alpha\text{back} \end{bmatrix} \rightarrow \phi \; / \; \begin{bmatrix} +\text{voc} \\ -\text{cons} \\ +\text{low} \\ \alpha\text{back} \end{bmatrix} \text{——}$$

As already observed in our discussion of Wallis, the Fronting Rule (31) must precede Monophthongization, since otherwise the reflex of tense /ā/ would merge with that of the diphthong /āw/.

In Table 4 we illustrate the derivations of the phonetic reflexes attested in Cooper's speech from underlying representations that are identical with those of ME and hence with those of Hart and Wallis.

A comparison of Table 4 with Tables 1 and 3 reveals important similarities which reflect the close genetic relationship of Cooper's dialect with that of Hart and of Wallis.

TABLE 4. *Derivation of the phonetic reflexes in Cooper's dialect from underlying representations essentially identical with those of ME*

	ī	ē	ǣ	ā	ɔ̄	ō	ū	ēw	ǣw	ǣy	ā̄w	ɔ̄w	ɔ̄y	i	e	a	o	u	
u-UNROUNDING (33Ia)																		u	ɨ
o-LOWERING (33IV)																	ɔ		
æ-RAISING (36)			ē						ēw	—									
GLIDE INSERTION (19a)								yēw	yēw										
DIPHTHONGIZATION (19b)	īy						ūw												
VOWEL SHIFT (26)	ēy	ī	ī			ū	ōw	yīw	yīw									o	
FRONTING (31)				ǣ												æ			
MONOPHTHONGIZATION (38)										ǣ	ā	ɔ̄							
DIPHTHONG LAXING (37)	oy						ow	yɨw	yɨw				ɔy						
VOWEL RAISING (30b)				ē	ō					ē		ō							
ROUNDING ADJUSTMENT (29)	ʌy						ʌw	yuw	yuw		ɔ̄							ʌ	u
	ʌy	ī	ī	ē	ō	ū	ʌw	yuw	yuw	ē	ɔ̄	ō	ɔy	i	e	æ	ɔ	ʌ	u

If it can be supposed that the three dialects reviewed up to this point represent parallel but distinct developments from the same underlying base, then the set of rules underlying the derivations in Table 4 may be taken as showing the traces of this development. A comparison of Table 4 with Hart's dialect (Table 1, p. 266), which represents an earlier stage in the same general development, would then indicate that during the century and a quarter that intervened between Hart and Cooper the changes under discussion in this chapter were brought about mainly by the addition to the grammar of the following rules: *u*-Unrounding, *o*-Lowering (33IV), æ-Raising (36), Fronting (31), Monophthongization (38), and Rounding Adjustment (29).

The order in which these rules are mentioned here does not correspond to their relative chronology, for as noted above there is no reason to suppose that rules are always added at a fixed point in a grammar. In fact, we have seen that the æ-Raising Rule (36) and *u*-Unrounding Rule, which must precede the Vowel Shift in the synchronic order of the rules, are historically later than the Vowel Shift.

The set of rules developed above and illustrated in the derivations of Table 4 presupposes that the underlying representations for Cooper's dialect were substantially identical with those for Wallis' and Hart's. This assumption, however, is not correct, for the same phonetic facts can be produced by an alternative grammar that requires fewer features and must therefore be preferred over Table 4. This alternative grammar must now be examined.

In Cooper's speech the following four pairs of entities, distinct in ME, were merged: /ǣ/ and /ē/, /ǣy/ and /ā/, /ǣw/ and /ēw/, /ōw/ and /ō/. There were in the language no phonological processes that would require that the merged entities be assigned distinct underlying representations. This is easily seen with regard to the tense /ǣ/ and /ē/, for well before the sixteenth century these two vowels merged into a single lax vowel when subjected to the Laxing Rule. Thus we found in Hart such alternations as [kīp] (from underlying /kēp/) and [kept] and [mēn] (from underlying /mǣn/) and [ment]. The Laxing Rule therefore provides no motivation for keeping the distinction between the two tense vowels in the underlying representations once the vowels had merged phonetically.

A similar situation prevailed with regard to /ǣy/ and /ā/. In the environment where tense vowels were laxed, the diphthong /ǣy/ was replaced by the reflex of lax /a/, as shown clearly in the spellings *vain–vanity*. As far as we are able to tell, the language did not possess any other alternations that might require keeping these entities distinct in lexical representations. Hence, in place of /ǣy/ and /ā/ the lexical representations contained a single entity.

The low diphthongs /ǣw/ and /ōw/ did not participate in tenseness alternations either. They did, however, play a role in alternations of back and front vowels that are of some consequence in the verbal inflections; e.g., *know–knew*, *draw–drew*, *blow–blew* could be accounted for quite naturally by the set of rules in Table 4 if it is assumed that the diphthongs are distinct from the tense vowels with which they merged phonetically. However, the role of these alternations is so marginal in the language at this point that they alone could hardly justify maintaining the underlying entities as distinct after the phonetic reflexes of the diphthongs had merged.

If, then, the four pairs above are to be assumed to have merged, we must next ask what their respective underlying representations ought to be. If in place of /ǣ/ and /ē/ we postulate /ē/, and, analogously, in place of /ǣw/ and /ēw/ we assume /ēw/, we can immediately dispense with the æ-Raising Rule (36). This move, moreover, allows us to represent the pair /ǣy/ and /ā/ by /ǣ/. A consequence of the latter decision is that we no longer have

need for the Fronting Rule (31), for there is nothing to prevent us from postulating an underlying lax /æ/ in place of /a/. If, finally, we represent /ɔ̄w/ and /ɔ̄/ by /ɔ̄/, we need no longer include the Monophthongization Rule (38) in the grammar, provided that we represent /āw/ as /ā/. The latter is clearly desirable since it fills a hole in the pattern, as it were, created by the merger of original /ā/ with /ǣy/, and since, moreover, it reduces further the number of diphthongs in the underlying representations.

With these modifications, Cooper's dialect emerges with the underlying system as in (39):

(39)

ī		ū	i	u		
ē		ō	e	o	ēw	
ǣ	ā	ɔ̄	æ			ɔ̄y

The appropriate phonetic reflexes can then be derived with the help of the following rules:

(40)

o-Lowering (33IV)
Glide Insertion (19a)
Diphthongization (19b)
Vowel Shift (26)
Diphthong Laxing (37)
Vowel Raising (30b)
Rounding Adjustment (29)

The derivation of these reflexes thus proceeds as shown in Table 5.

TABLE 5. *Derivation of the phonetic reflexes in Cooper's dialect from underlying representations that have undergone restructuring*

	ī	ē	ǣ	ā	ɔ̄	ō	ū	ēw	ɔ̄y	i	e	æ	o	u (u / i)	
o-LOWERING (33IV)													ɔ		
GLIDE INSERTION (19a)								yēw							
DIPHTHONGIZATION (19b)	īy						ūw								
VOWEL SHIFT (26)	ēy	ī				ū	ōw	yīw						o	
DIPHTHONG LAXING (37)	oy						ow	yiw	ɔy						
VOWEL RAISING (30b)			ē		ō										
ROUNDING ADJUSTMENT (29)	ʌy			ɔ̄			ʌw	yuw						ʌ	u
	ʌy	ī	ē	ɔ̄	ō	ū	ʌw	yuw	ɔy	i	e	æ	ɔ	ʌ	u

5. T. Batchelor (1809)

The *Orthoëpical Analysis of the English Language*,[17] which T. Batchelor published in 1809, is apparently the earliest work in which the diphthongal quality of all English tense vowels is specifically recognized. In Batchelor's work reference is made to "a grammar of the

[17] We express our gratitude to Mr. W. M. Whitehill, director of the Boston Atheneum, for the loan of a copy of this book.

English Tongue which was published anonymously by J. Roberts, Warwick-Lane, in 1721, and contained (among many correct and some erroneous observations), almost the whole of the theory which makes the subject of the following pages" (p. vi). Since this book apparently has not been located (see Jespersen, 1909, p. 327), and since the comments in Batchelor are not clear on this point, we are unable to determine whether diphthongization of tense vowels was attested in English before the nineteenth century. Jespersen is inclined to believe that it was in the language long before Batchelor. His arguments, however, have failed to convince many scholars (see, e.g., Horn, 1912) and do not appear especially compelling to us, either. It seems to us safest, therefore, to assume that the reason for the absence of earlier testimony to the diphthongization of English tense vowels is not the lack of acuity of pre-nineteenth-century phoneticians and orthoepists, but rather the absence of the phenomenon.

5.1. THE EVIDENCE

Batchelor recognizes "eight vowels in English which possess a specific difference of character" (p. 21). These are:

(41)

i as in *swim*, *wit*
e as in *met*, *den*
u as in *pull*, *bull*
u as in *but*, *run*
u̧ as in *rostrum*, *honour* (unaccented)
a as in *pat*, *man* and *bard*, *task*[18]
o as in *not*, *top* and *order*, *offer*, *owl*[19]
c as in *rogue*, *broke*[20]

The phonetic descriptions given by Batchelor are unfortunately not models of clarity so that questions may well be raised concerning some of the identifications proposed below. There is no problem about the first five sounds; they obviously must be [i], [e], [u], and stressed and unstressed [ʌ]. If we assume that Batchelor's *o* represents [ɔ] and his *a* represents [æ], then his *c*, which is of very restricted distribution, should be identified with [o]. Batchelor's comments on *c* support this interpretation:

> To pronounce this sound, the tongue is more elevated in the middle than in the *o* in *hot awl*, &c; its highest part is also farther from the throat, though the tip of it is retracted farther from the teeth. The tone of this *short provincial o* has some degree of similarity with the *o* in *hot*, &c.; yet it is perceptibly softer, possesses less strength and distinctness, and seems rather more easy to pronounce (p. 9).

In describing the reflexes of the tense vowels in his speech, Batchelor observes:

> In the preceding table, the vowels which are heard in *tree*, *hey*, *buy*, *boy*, and *ay* are represented as diphthongs, which are formed by the junction of (y) consonant with the simple vowel sounds.
>
> The errors which modern grammarians have promulgated, with respect

[18] "These sounds are justly considered by modern grammarians to differ only in length" (p. 8).

[19] "These two sounds are also specifically the same, the latter being only the lengthened sound of the former" (p. 8).

[20] "The sound which is here intended, is not similar to that heard in the words *tone*, *moan*, &c. The latter will be found to be true diphthongs; but the simple sound is heard only in the instances which are given, and a few others, when pronounced short, in the provincial manner" (p. 9).

> to these diphthongs, have originated in great measure, from the difficulties which attend the subject, but principally in the absurd suppositions, that sounds cannot be described by words, and that it is of little consequence whether they can or not. [An opinion which, as Batchelor notes (p. v), his contemporaries owe to the redoubtable Dr. Samuel Johnson—NC/MH.] The distinction between *y* and short *i* has been sufficiently pointed out; and those who attentively examine the articulation of the long and slender sound which is represented by *ee* in *tree*, will find that the tongue makes a nearer approach towards the palate in the termination of that diphthong, than happens in the beginning of it. The ear may also distinguish a slender sound, followed by one still more slender, which is consequently the *y* consonant, and proves that *y* ought to be sounded exactly the same, as to the quality of the tone, whether it precedes or follows a vowel, though the strength of it will naturally be diminished at the end of a syllable (p. 52).
>
> The radical vowels of the diphthongs which end in *y* consonant, as it is termed, are heard in the syllables *sin*, *bel*, *wed*, *but* and *hol*; and the insertion of a *y* between the vowels and the last consonant produces the sounds heard in *seen* (siyn), *bail* (beyl), *wade* (weyd), *bite* (buyt), and *hoyle* (hoyl) (p. 53).

We conclude from this that Batchelor had the following diphthongs in [y]: [iy], [ey], [ʌy] (which are the reflexes of /ē/, /ǣ/, /ī/, respectively, in his grammar), and [ɔy]. In addition, Batchelor had the diphthong [ay] in one word only:

> The word (ay) signifying *yes*, is, I believe, the only diphthong of that kind in the English language. The radical sound of this diphthong is unquestionably the *a* in *father*; and it forms a combination very unlike the *i* in *mind*, *pint*, &c. (p. 54).

We shall not include this diphthong in our analysis as it clearly is an idiosyncracy of Batchelor's dialect without systematic significance.

> The diphthongs which are formed by a final (w) are only three: the radical vowels on which they are founded, are heard in *pond*, *pull*, and the short provincial *o* in *broke* (brck); the insertion of (w) between the vowel and last consonant, changes *pond* into *pound* (pownd), *pull* (pul) into *pool* (puwl), and *brŏke* into *broke* (brcwk) (p. 55).

Batchelor thus recognizes three diphthongs in [w]: [ɔw], which is the reflex of tense /ū/; [uw], reflex of tense /ō/; and [ow], reflex of tense /ɔ̄/. It is to be noted that there is a curious asymmetry in his diphthongal system: the reflex of tense /ū/ is [ɔw], whereas that of tense /ī/ is, as we have seen above, [ʌy]. To account for this asymmetry, special rules will be required.

Finally, like Cooper, Batchelor has a triphthong in his speech:

> The long *u* of the English alphabet may be termed a triphthong, as it consists of the *u* in *pull*, followed by *w* and preceded by *y* (p. 57).

5.2. BATCHELOR'S PATTERN

Batchelor's speech thus contained seven diphthongs: [iy], [ey], [ʌy], [ɔy], [uw], [ow], [ɔw]; one triphthong: [yuw]; six lax monophthongs: [i], [e], [æ], [ɔ], [ʌ], [u]; and two tense monophthongs: [ǣ] or [ā] found in *hard*, *task*, *father*, and [ɔ̄] found in *awe*, *order*, *offer*. In (42) we show the major ME antecedents of these sounds.

(42)

The similarity between (35), which represents Cooper's speech, and (42) is so striking that it is clear that both dialects must be derived from very similar underlying representations. Further examination of (35) and (42) reveals that the essential difference between the two dialects lies in the fact that in Batchelor's dialect the reflexes of all tense vowels are diphthongized, whereas they are mostly monophthongal for Cooper. In other words, if we can assume that Batchelor's dialect evolved from a dialect that was like Cooper's in having both diphthongs and monophthongs as reflexes of tense vowels, we must suppose that the change was effected by means of generalizing the Diphthongization Rule (19b). Generalizations of this kind constitute one common type of phonological change. In this case the generalization consists of dropping the feature specification [+high] in rule (19b). It is necessary to exempt the vowel /ā/ from Diphthongization (see Table 6 and the accompanying discussion, p. 286). There are several alternatives available to accomplish this. A motivated choice among them could only be made on the basis of a much deeper study of Batchelor's dialect than we are at the moment able to undertake. We therefore assume quite arbitrarily that Diphthongization of /ā/ is blocked by a readjustment rule.

The proposed generalization, however, would incorrectly turn the two diphthongs that were still found in Cooper's dialect into sequences of tense vowel followed by two glides. The most direct way of preventing this is by representing the diphthongs by tense vowels of appropriate feature composition. The generalized Diphthongization Rule will then insert the requisite glides without further difficulty. As noted in Chapter Four, the choice of the monophthongs to represent the diphthongs in question is limited by two facts: they must be distinct from all other tense vowels, and they must be [+back] if they have the glide [w] in the output, and [−back] if the glide in the output is [y]. Consequently the monophthong underlying [ɔy] will have to be [−back], whereas the one underlying [yuw] will have to be [+back]. The obvious candidates in view of these considerations are /ǣ/ for [ɔy] and /ɨ/ for [yuw]. This choice, however, has further consequences, for the machinery to turn these vowels into [ɔ] and [yu], respectively, is still lacking.

It is obvious that the Glide Insertion Rule (19a) must now be modified, because we shall want to insert [y] before tense [ɨ], that is, in the environment:

(43)

$$\_\_ \begin{bmatrix} +\text{voc} \\ -\text{cons} \\ +\text{tense} \\ +\text{high} \\ +\text{back} \\ -\text{round} \end{bmatrix}$$

Next we must modify the Vowel Shift Rule, for in the form given in (26) it would apply to /ɨ̄/ and turn it into [ʌ̄]. We therefore impose the condition on Vowel Shift that it applies only to tense vowels that agree in backness and rounding.

At this point in our exposition, it is helpful to stop and survey the results of the changes introduced so far. These are presented in Table 6.

TABLE 6.

								ū						u	
	ī	ē	ǣ	ā	œ̄	ɔ̄	ō	ū	ɨ̄	i	e	æ	o	u	ɨ
GLIDE INSERTION (43)									yɨ̄						
DIPHTHONGIZATION (19b)	īy	ēy	ǣy	—	œ̄y	ɔ̄w	ōw	ūw	yɨ̄w						
VOWEL SHIFT (26)	ēy	īy					ūw	ōw						o	
BATCHELOR'S OUTPUT	ʌy	iy	ey	ɔ̄	ɔy	ow	uw	ɔw	yuw	i	e	æ(ǣ)	ɔ(ɔ̄)	ʌ	u

Examination of Table 6 shows that tense /ā/ is unique in that it eventuates in a monophthong rather than in a diphthong. We recall that in the dialect of modern English described in Chapters One through Five, the tense low vowels have centering glides, and it is not unlikely that Batchelor's dialect was similar to modern English in this respect. Since he specifically states, however, that he had monophthongs in these positions, we have formulated the rules here so that monophthongs will be produced in the appropriate environments. We have done this by assuming that the dialect was subject to a special readjustment rule which exempted /ā/ from the Diphthongization Rule. We note, however, that this rule may reflect nothing other than a difference between the phonetic notation of Batchelor and that of modern phoneticians.

We now observe a curious set of correspondences between the representations derived by the three rules discussed in the preceding paragraphs and the phonetic output (see Table 6). What appears in the output as [ey], [ow], [ɔw] is represented in this stage of the derivation as [ǣy], [ɔ̄w], [ōw], respectively. Omitting from consideration for the moment the difference in tenseness between the two sets of forms, the three diphthongs appear to have undergone a second Vowel Shift, one that affects only nonhigh vowels and that exchanges their coefficients for the feature "low." We observe, moreover, that the tense vowels involved in this second Vowel Shift, like those involved in the first Vowel Shift, agree in backness and rounding. The two Vowel Shifts can therefore readily be incorporated into one rule:

(44) VOWEL SHIFT

$$[+\text{stress}] \rightarrow \left\{ \begin{array}{ll} \text{(a)} & [-\beta\text{high}] \;/\; \begin{bmatrix} \overline{\quad} \\ \beta\text{high} \\ -\text{low} \end{bmatrix} \\ \text{(b)} & [-\gamma\text{low}] \;/\; \begin{bmatrix} \overline{\quad} \\ \gamma\text{low} \\ -\text{high} \end{bmatrix} \end{array} \right\} \;/\; \left\{ \begin{array}{l} \begin{bmatrix} \overline{\quad} \\ +\text{high} \\ +\text{back} \\ -\text{tense} \end{bmatrix} \\ \begin{bmatrix} \overline{\quad} \\ \alpha\text{back} \\ \alpha\text{round} \\ +\text{tense} \end{bmatrix} \end{array} \right\}$$

The effect of this extension of the Vowel Shift is to convert the vowels /ī/, /ǣ/, /ɔ̄/, /ū/, respectively, into [ǣy], [ēy], [ōw], [ɔ̄w], leaving the reflexes of /ē/, /ō/ intact, as shown in Table 7.

TABLE 7.

								ū						u	
	ī	ē	ǣ	ā	œ̄	ɔ̄	ō	ū	ɨ̄	i	e	æ	o	u	ɨ
GLIDE INSERTION (43)									yɨ̄						
DIPHTHONGIZATION (19b, modified)	īy	ēy	ǣy	—	œ̄y	ɔ̄w	ōw	ūw	yɨ̄w						
VOWEL SHIFT (44a)	ēy	īy					ūw	ōw						o	
VOWEL SHIFT (44b)	ǣy		ēy			ōw		ɔ̄w							
BATCHELOR'S OUTPUT	ʌy	iy	ey	ɔ̄	ɔy	ow	uw	ɔw	yuw	i	e	æ(ǣ)	ɔ(ɔ̄)	ʌ	u

Before continuing our discussion of Batchelor's vowel pattern, we comment briefly on the possible historical steps whereby this evolution of the Vowel Shift Rule took place. We recall that most of the work done by the second part of the Vowel Shift Rule was performed in Cooper's grammar by the Vowel Raising Rule (30b). It seems likely, therefore, that what triggered the restructuring observed in Batchelor's grammar was the addition, to the end of a grammar like that of Cooper, of a special Vowel Lowering Rule such as (45) to lower [ʌw] to [ɔw]:

(45)
$$\begin{bmatrix} -\text{high} \\ +\text{back} \\ -\text{round} \end{bmatrix} \rightarrow \begin{bmatrix} +\text{low} \\ +\text{round} \end{bmatrix} \Big/ \ \text{---} \begin{bmatrix} -\text{voc} \\ -\text{cons} \\ +\text{back} \end{bmatrix}$$

The addition of such a rule, however, resulted in a highly unstable situation, since the same phonetic effects can be produced with a simpler set of rules where the Vowel Raising and Vowel Lowering Rules are replaced by the second part of the Vowel Shift.

As can be seen from Table 7, to obtain the correct results for Batchelor's speech, we need adjustments in rounding. In particular, the lax [ɨ] which is a reflex of /u/, the tense [ɨ̄] in the triphthong [yɨ̄w], and the tense /ā/ must be rounded, whereas what appears at this stage in the derivation as lax [o] (from /u/) must be unrounded. As before we shall use Rounding Adjustment for this purpose, but we shall have to change the environment in which it applies, as follows:

(46) ROUNDING ADJUSTMENT

$$\begin{bmatrix} +\text{back} \\ \alpha\text{round} \end{bmatrix} \rightarrow [-\alpha\text{round}] \Big/ \left\{ \begin{array}{ll} \left[\begin{bmatrix} \overline{} \\ -\text{low} \\ -\alpha\text{high} \end{bmatrix}\right] & \text{(a)} \\ \left[\begin{bmatrix} \overline{} \\ +\text{tense} \\ -\text{round} \end{bmatrix}\right] & \text{(b)} \end{array} \right\}$$

Part (a) of the Rounding Adjustment Rule affects tense and lax [ɨ] and [o], whereas part (b)

affects only tense [ā] and [ʌ̄], of which the latter is the result of unrounding of [ōw] < /ō/ by part (a) of Rounding Adjustment. It is to be noted that not all instances of /ā/ will be subject to Rounding Adjustment. Those that are exempt from it, e.g., /ā/ in polysyllables such as *father*, will be so marked either in the lexicon or by a special readjustment rule. Moreover, not all instances of tense [ō] are to be derived from an underlying tense /ā/. As indicated by Batchelor's examples, other sources for this vowel must be /ɔ/ before /r/ and before voiceless fricatives. The rule required here is in fact more general, for it also accounts for the tense monophthong [ǣ] in such words as *bard* and *task* (see p. 283). There are no doubt other such phenomena in Batchelor's dialect, but they do not appear clearly from the limited number of examples under consideration here. We shall not attempt to state any of these additional rules.

At this stage only two major discrepancies remain between the representations produced by our rules and the phonetically attested output. The diphthongs must be laxed, and it is necessary to make the vowels back in the diphthongs [ǣy] and [ɑ̄y]. The latter can readily be effected by the following rule:

(47) BACKNESS ADJUSTMENT

$$\begin{bmatrix} +\text{low} \\ +\text{tense} \end{bmatrix} \rightarrow [+\text{back}]$$

Rule (47) assures that all tense low vowels are back. This rule is followed by a generalized and simplified version of the Diphthong Laxing Rule (37).

TABLE 8. *The derivation of the vowels and diphthongs in Batchelor's dialect*

	ī	ē	ǣ	ā	ɑ̄ǣ	ō	ō	ū	ɨ̄	i	e	æ	o	u	ɨ
								ū						u	
o-LOWERING (33IV)													ɔ		
GLIDE INSERTION (43)									yɨ̄						
DIPHTHONGIZATION (19b, modified)	īy	ēy	ǣy	—	ɑ̄ǣy	ōw	ōw	ūw	yɨ̄w						
VOWEL SHIFT (44a)	ēy	īy					ūw	ōw						o	
VOWEL SHIFT (44b)	ǣy		ēy			ōw		ōw							
ROUNDING ADJUSTMENT (46a)						ʌ̄w			yūw					ʌ	u
ROUNDING ADJUSTMENT (46b)				ō		ōw									
BACKNESS ADJUSTMENT (47)	ā̄y				ɔ̄y										
DIPHTHONG LAXING (48)	ay	iy	ey		ɔy	ow	uw	ɔw	yuw						
ay-RAISING (49)	ʌy														
	ʌy	iy	ey	ō	ɔy	ow	uw	ɔw	yuw	i	e	æ(ǣ)	ɔ(ō)	ʌ	u

(48) DIPHTHONG LAXING

$$V \rightarrow [-\text{tense}] \; / \; \text{——} \begin{bmatrix} -\text{voc} \\ -\text{cons} \end{bmatrix}$$

It yields the correct results in all but one case: the reflex of /ī/ produced by these rules is [ay], whereas according to Batchelor's testimony the correct reflex is [ʌy]. This discrepancy can readily be repaired by a rule raising [ay] to [ʌy]:

(49)

$$\begin{bmatrix} -\text{high} \\ +\text{back} \\ -\text{round} \end{bmatrix} \rightarrow [-\text{low}]$$

It is likely that Batchelor's dialect was somewhat unusual in this regard, for, as Batchelor himself notes, his near contemporary John Walker recommends a pronunciation with "*a* as in *father*" (p. 54), that is, [æy] or [ay].

In Table 8 we illustrate the derivation of the attested phonetic reflexes from the postulated underlying representations. The striking similarity of the rules employed here with those discussed in Chapter Four is, of course, not surprising, for only a century and a half separate us from the time of T. Batchelor.

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PART IV
PHONOLOGICAL THEORY